



This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

- + *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.
- + *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.
- + *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.
- + *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at <http://books.google.com/>

S 7900.8.50

BOWEN

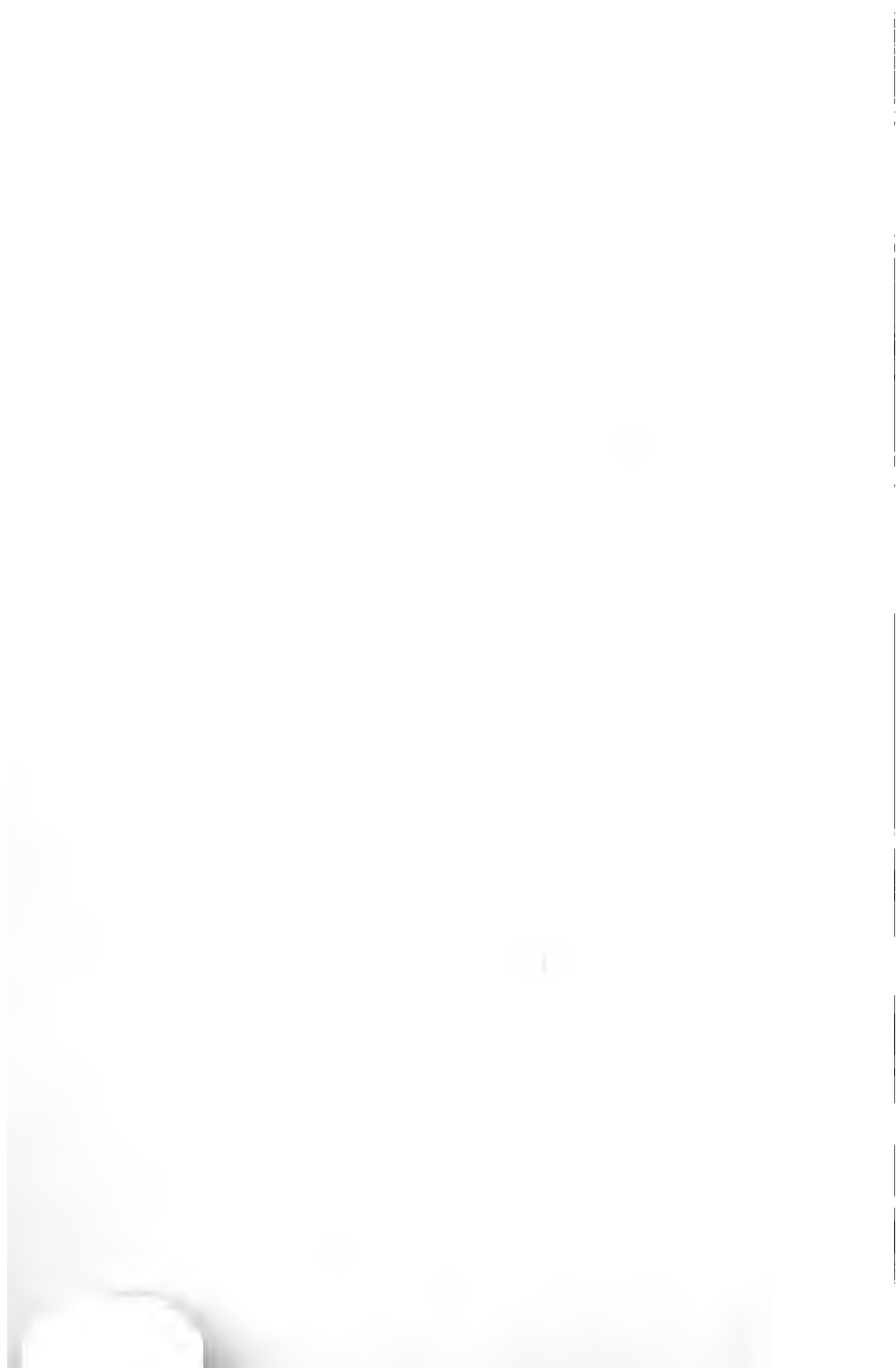
VESTIGES OF THE NATURAL
HISTORY OF CREATION

S 7900.8.50

The gift of

CAPT. C. H. DAVIS, U. S. N.

 HARVARD COLLEGE LIBRARY 



200

o 1. See Opposite.

2. [Gray, Asa]. Explanations of the Ves-
tiges, etc. [Boston? 1845?]]

11
A THEORY OF CREATION.

A

REVIEW

OF

VESTIGES OF THE NATURAL HISTORY OF
CREATION."/

By Francis Bowen.

FROM THE NORTH AMERICAN REVIEW FOR APRIL, 1845.

⁵⁺
BOSTON:

OTIS, BROADERS, AND COMPANY,

120 WASHINGTON STREET.

1845.

~~AH 3558.45~~

S 7900.8.50

✓ 1859, Sept. 19. Gift

Capt. C. B. Davis, U.S.A.,
of Cambridge.

CAMBRIDGE:
METCALF AND COMPANY,
PRINTERS TO THE UNIVERSITY.

THEORY OF CREATION.

Vestiges of the Natural History of Creation. New York :
Wiley & Putnam. 1845. 12mo. pp. 291.

THIS is one of the most striking and ingenious scientific romances that we have ever read. The writer of it is a bold man ; he has undertaken to give a hypothetical history of creation, beginning, as the title-pages say, at the earliest period, and coming down to the present day. It is not quite so authentic as that of Moses, nor is it written with such an air of simplicity and confidence as the narrative of the Jewish historian ; but it is much longer, and goes into a far greater variety of interesting particulars. It contradicts the Jewish cosmogony in a few particulars, and is at variance with probability and the ordinary laws of human reasoning in many others. But the rather liberal rules of interpretation, which it is now the fashion to apply to the first chapter of Genesis, will relieve the reader from any scruples on the former account ; and as to the latter, in these days of scientific quackery, it would be quite too harsh to make any great complaint about such peccadilloes. The writer has taken up almost every questionable fact and startling hypothesis, that have been promulgated by proficient or pretenders in science during the present century, except animal magnetism ; and for this omission we have reason to be thankful. The nebular hypothesis, Laplace's or Compté's theory of planets *shelled off* from the sun, spontaneous generation, — some of these vagaries, we admit, are of much older date than the year 1800, — the Macleay system, dogs playing dominoes, negroes

born of white parents, materialism, phrenology, — he adopts them all, and makes them play an important part in his own magnificent theory, to the exclusion, in a great degree, of the well-accredited facts and established doctrines of science.

We speak lightly of the author's plan, as one can hardly fail to do of a scheme so magnificent, and going apparently so far beyond the ordinary sources of information and the range of the human intellect. But the execution of the work is of so high an order, as fairly to challenge attention and respect. The writer, who has not chosen to give his name to the world, is evidently a man of great ingenuity and correct taste, a master of style, a plausible, though not a profound, reasoner, and having quite a general, but superficial, acquaintance with the sciences. His materials are arranged with admirable method, the illustrations are copious and interesting, the transitions are skilfully managed, and the several portions of the theory are so well fitted to each other, and form such a round and perfect whole, that it seems a pity to subject it to severe analysis and searching criticism. It is a very pleasant hypothesis, set forth in a most agreeable manner; and though it contains many objectionable features, these are cautiously veiled and kept in the background, and the reader is seduced into accepting most of the conclusions, before he is aware of their true character and tendency.

Before a just opinion can be formed of the correctness of the writer's views, it is necessary to take to pieces this skilful fabric, and to bring the parts together in a different connection and with greater succinctness, following out each doctrine to its inevitable, but most remote, conclusions, so as to obtain a just idea of the position in which we should be placed by the acceptance of the theory as a whole. For obvious reasons, the author has not chosen to give a general summary of his views, or to mention explicitly all the inferences that may be drawn from them. He merely puts the reader upon the track, indicating its general direction, and leaving it for him to find out what objects will be encountered by the way, and where the journey will end. We propose to finish the work that is thus left incomplete, and to set forth the doctrine in its plainest terms. We would reduce the theory at once to its narrowest compass and simplest expression; but at the same time, would incorporate into it every doctrine which properly belongs to it, and follow out each hypothesis to its

remote, though necessary, inferences and conclusions. To this end, it is requisite to separate, as far as possible, the doctrines themselves from the evidence adduced in support of them; and to consider the former as a whole, before proceeding to discuss the cogency of the latter. The following may be taken as the most concise abstract that we can form of the history of the creation, according to this author.

In the beginning — we use this word in a kind of preter-perfect sense — in the *very* beginning of things, immense portions of infinite space were filled with finely diffused nebulous matter, heated to an intensity that is altogether inconceivable. The particles of this “fire mist,” as it is appropriately called, were the true *primordia rerum*, — the elements of the universe, — the principles of all the forms of inorganic matter and all organic things. At the outset, the Creator endowed these particles with certain qualities and capacities, and then stood aside from his work, as there was nothing farther for him to do. The subsequent progress of creation is only the successive *development*, upon mechanical and necessary principles, and as fast as proper occasions were offered, of these qualities thus made inherent in the primitive constitution of matter. The atoms thus marvellously endowed have gone on, without any further aid from Almighty power, to form suns, and astral systems, and planets with their satellites, and worlds tenanted by successive generations and races of vegetable and animal things. And this work of creation, or rather of development, is still in progress all around us, and in all its various stages, though in the portion most directly exposed to the observation of man it is far advanced towards perfection. Upon this earth, the unaided action of these atoms is still evolving all the phenomena of generation, progress, and decay, of vegetable and animal life, of instinct and of mind. In the abyss of space, it is also forming new suns, and solar systems, and worlds that are to pass through the same stages and wonderful transformations to which our own planet has already been subjected. All that has occurred with respect to this earth, and the system of which it forms a part, is but a type of what is constantly going on in the countless other systems of stars that people the firmament.

The first stage in the history of these fiery particles is the formation among them, in some unaccountable way, of

nuclei, or centres of aggregation, like the bright points that are now visible in some of the nebulae of the heavens. As soon as these centres are formed, gravity, one of the original principles of matter, begins to act, and the atoms in all the neighbouring parts of space are attracted towards the nucleus and heaped upon it. In this manner, a central sun of vast dimensions is formed, which soon assumes a motion of rotation upon its axis from the general law which gives a circular movement to all fluids that are drawn towards a common centre. The centrifugal force thus generated tends to throw off matter from the equatorial regions of the great orb, but is restrained by the attraction of gravitation, which would prevent any separation of the parts, if the sun itself did not now begin to cool down, and consequently to shrink in size. Under this cooling process, a crust is formed upon the surface, too rigid to yield to the force of gravity, and the parts within, continuing to shrink, separate from this envelope; so that there is now a central orb, revolving more rapidly from its greater density and smaller diameter, and surrounded by an exterior shell, or band, like Saturn's ring, rotating at its original speed. As we cannot suppose that the ring would usually be of uniform thickness and strength, it eventually breaks up into fragments, the larger of which attracts the smaller into itself, and the whole is formed by its revolving motion into an oblate spheroid circling round the contracted sun in the centre. In this manner, the planet Uranus was shelled off from our sun, which originally filled the whole of the vast sphere, of which the distance from Uranus to the centre of the present sun is but the radius. The planet itself, by the same process of cooling, shrinking, and thus forming exterior rings, threw off successively all its six satellites; and the sun, also, continuing to contract from the loss of heat, formed another ring, and thus constituted the planet Saturn. In this way were formed successively all the planets and satellites of the present solar system. The original diameter of our earth was equal, of course, to the present diameter of the moon's orbit. In the case of Saturn, the two rings formed around it happened to be of unusual homogeneity and equal thickness, so that they were not broken up, but have preserved their primitive shape. A ring was formed from the sun in the space between the present orbits of Mars and Jupiter; but when it was broken up, the frag-

ments did not congregate into one, but spherified separately, so as to form the four smaller planets which now revolve in that opening.

“ We have no means of judging of the seniority of systems ; but it is reasonable to suppose, that, among the many, some are older than ours. There is, indeed, one piece of evidence for the probability of the comparative youth of our system, altogether apart from human traditions and the geognostic appearances of the surface of our planet. This consists in a thin nebulous matter, which is diffused around the sun to nearly the orbit of Mercury, of a very oblately spheroidal shape. This matter, which sometimes appears to our naked eyes, at sunset, in the form of a cone projecting upwards in the line of the sun’s path, and which bears the name of Zodiacal Light, has been thought a residuum or last remnant of the concentrating matter of our system, and thus may be supposed to indicate the comparative recentness of the principal events of our cosmogony. Supposing the surmise and inference to be correct, and they may be held as so far supported by more familiar evidence, we might with the more confidence speak of our system as not amongst the elder born of Heaven, but one whose various phenomena, physical and moral, as yet lay undeveloped, while myriads of others were fully fashioned and in complete arrangement. Thus, in the sublime chronology to which we are directing our inquiries, we first find ourselves called upon to consider the globe which we inhabit as a child of the sun, elder than Venus and her younger brother Mercury, but posterior in date of birth to Mars, Jupiter, Saturn, and Uranus ; next, to regard our whole system as probably of recent formation in comparison with many of the stars of our firmament. We must, however, be on our guard against supposing the earth as a recent globe in our ordinary conceptions of time. From evidence afterwards to be adduced, it will be seen that it cannot be presumed to be less than many hundreds of centuries old.” — pp. 22, 23.

Having thus explained the *genesis* of the solar system, we come down to the history of our own earth, since it shelled off the ring which formed our moon. Continuing to cool down and shrink, a thin but rigid crust of primary rocks, still bearing marks of the intense heat to which they have been subjected, was formed upon its surface ; and then the vapors, with which the atmosphere had been charged, were condensed, and formed seas, which covered the whole, or the

greater part, of the earth's rind. The continual agitation of these waters, and their high temperature, as they were still nearly at the boiling point, disintegrated and wore down many of these rocks, and, in the lapse of ages, deposited their remains, in thick layers of sand and mud, at the bottom of the seas. Baked by the heat from beneath, and pressed by the weight of superincumbent waters, these layers slowly hardened into stratified rocks. Forms of vegetable and animal life, though only of the lowest type, the origin of which is to be explained hereafter, now began to appear. Some sea-plants, zoöphytes, infusory animalcules, and a few of the molluscous tribe, all low down in the order of being, but important from their immense numbers and joint action, commenced their work of absorbing the carbonic acid with which the air was overcharged, and building up vast piers and mounds of stone from their own remains. Meanwhile, the internal fires of the earth occasionally broke through the rocky crust that imprisoned them, threw up liquid primitive rock through the rents, and distorted and tilted up the strata that had been formed above.

We may remark, in passing, that the chronology of the events of which we now speak is not very accurately determined ; the only thing certain about it is, that a series of ages, so protracted that the imagination cannot conceive their number, elapsed between the successive epochs in the history of the earth's crust. Some of the convulsions caused by the fiery mass within threw up rock above the surface of the waters, and thus the dry land began to appear. Islands were formed, and immediately land-plants made their appearance, of excessive luxuriance, under the tropical temperature that still prevailed all over the globe, and began their office of absorbing carbon, and storing it up for future use. Land-animals as yet were not, for the excess of carbonic acid in the atmosphere rendered it incapable of supporting animal life. But the richness of this island vegetation gradually purified the air ; while the decaying plants themselves, being accumulated into vast beds and strata, and subjected, through the changes of the earth's surface, to the pressure of mighty waters, gradually formed immense deposits of coal, for the subsequent service of man. Animals of a higher grade were now formed ; fishes became abundant, and amphibious mon-

sters, huge lizards and other reptiles, with an imperfect apparatus of respiration, began to breathe an atmosphere not yet fitted for birds and mammifers.

It is not necessary to trace out the comparatively well known facts and theories of geological science, that are incorporated into this history. It is enough, for the present purpose, to point out a few of the general conclusions of the geologist respecting the several great changes that the earth's crust has undergone, and the distinct races of vegetables and animals which have successively tenanted the earth's surface. These changes and these races have borne a constant relation to each other ; as the scenes shifted, the inhabitants also changed, the latter being always adapted to the circumstances in which they were placed. There has been a constant progress, the soil and the atmosphere becoming more and more fitted for the support of the higher forms of life ; and when all things were thus made ready for them, these higher forms have appeared, and the lower orders of being, which formerly occupied the scene, have entirely died out, so that their remains, entombed in the solid rock, are now the only indications of their past existence. In the era of the primary rocks, as we have seen, there was no organization or life, as there was nothing to support it. In the succeeding period, zoöphytes and mollusca appeared ; these were followed by fishes, and then land rose above the surface of the waters. Land-plants and animals came next, though of a low type ; continually advancing orders of beings, reptiles, birds, and mammifers, suited to the improved condition of things, successively appeared, until, at the latest epoch, man entered upon the scene, the head of animated nature as at present constituted, with powers and capacities well adapted for the full enjoyment of the augmented riches of the earth. And the end is not yet. "The present race, rude and impulsive as it is, is perhaps the best adapted to the present state of things in the world ; but the external world goes through slow and gradual changes, which may leave it in time a much serener field of existence. There may then be occasion for a nobler type of humanity, which shall complete the zoölogical circle on this planet, and realize some of the dreams of the purest spirits of the present race."

The question now occurs, How are we to account for the

origin of *life*, both in the vegetable and animal kingdoms ? The answer can readily be given, if we follow out resolutely to their remotest consequences the principles that have already been established. The evolution of natural laws, the necessary action of the qualities with which atoms were at first endowed, has sufficed to produce this complex system of mutually dependent worlds, and all the successive transformations of the earth's rind, which have fitted it for the support of successive races of organic beings. May not the same causes have produced the beings themselves ? The one process would seem to be not much more elaborate and intricate than the other. If the inherent qualities of matter have built up a solar system, they may have created, also, the first animalcule, the first fish, the first quadruped, and the first man. There has been a marked progress, in either case, from the chaotic, the rude, the imperfectly developed, up to the orderly, the complex, the matured forms. The first essays, the rude efforts, of nature have gradually been perfected. The chaotic world that was first shelled off from the sun differed not less widely from the admirably furnished planet we now inhabit, than does the zoöphyte, whose remains are not split out of the rock, from man, the present head of the animal tribe. At any rate, geology informs us, that the causes, whatever they may be, which produce life, have been long and frequently in operation. They were not exhausted in the first effort ; they are probably still at work throughout the universe. Not merely successive generations, but successive races, both of plants and animals, widely distinguished from each other, have, at different periods, tenanted the earth's surface. Those of which we possess the fossil remains belong, almost without exception, to extinct species. They were crowded out of existence, as it were, by the new forms, more perfectly organized, which came to take their places in the improving condition of things. This continuous agency of the life-producing causes, effecting still higher results by each successive effort, seems to point directly to the gradual expansion and development of the qualities with which matter was first endowed.

We actually see natural agents now at work around us, producing results which counterfeit life, if they do not constitute it. Many substances crystallize into shapes bearing a strong resemblance to vegetable forms, as in the well

known chemical experiment producing the *arbor Dianæ*. The passage of the electric fluid leaves marks that are like the branches and foliage of a tree, and the same fluid exerts a direct influence on the germination of plants. Some of the proximate principles of vegetable and animal bodies, such as urea and alantoin, are said to have been produced artificially by the chemist; and in the combination of the simple elements, such as carbon and oxygen, into these proximate principles, it is now acknowledged that there is no violation of the ordinary laws of chemical affinity. The origin of all vegetable and animal life, so far as it can be traced, is in germinal vesicles, or little cells containing granules. Such are the ova of all animals; and both vegetable and animal tissues are entirely formed from them. When the parent cells come to maturity, they burst and liberate the granules, which immediately develop themselves into new cells, thus repeating the life of their original. Now, it has been asserted, that globules can be produced in albumen by electricity; and *if these globules are true germinal vesicles*, the difficult problem of producing life by artificial means is entirely solved.

But the burden of this part of the theory rests on the evidence that has been produced of late years to favor the doctrine of equivocal generation, or the production of living beings without the agency, either direct or indirect, of parents of the same species. Can such beings, *orphans* in the strictest sense, now be produced or discovered? We have not space to repeat our author's argument on this difficult mooted question in science, nor is it necessary; he sums up the evidence on his own side, and of course finds it satisfactory, though the weight of authority is against him. He adduces the experiments of Mr. Crosse, repeated by Mr. Weekes, who claim to have produced animalcules in considerable numbers, of a species before unknown, by passing a voltaic current through silicate of potash, and through nitrate of copper. The existence of *entozoa*, or parasitic animals, found in the interior of the bodies of other animals, and found nowhere else, is thought to support the same doctrine. The question is, How came they there? Being too large, either in their perfect form, or in the egg, to have passed through the capillary blood-vessels, how came they within the body of another animal, — itself but a few weeks or a few days old,

or even in the embryo stage,—unless they were created there without parentage of their own species?

These facts and reasonings, it is true, only go to prove, that animalcules, or beings of very small size, and low in the scale of animated existence, can be produced in this way by the inherent qualities of matter. No one will pretend, that a dog, a horse, or a man can thus be created. How can we account for the existence of these larger animals of a higher type, admitted to have been denizens of the earth only since the latest geological epochs, and therefore of comparatively recent origin? Here we come to another point in our author's theory,—the transmutation of species, or the successive *development* of higher and higher orders of being out of the species immediately below them, through the accidental or natural fulfilment of certain conditions, in the course of a long period of years.

Natural history teaches us, that there is quite a regular gradation among the several tribes of vegetables and animals; though we may not be able to range all the species, as constantly advancing in a single line, there is certainly the general appearance of a scale, beginning with the most simple, and going on to the most complex forms. While the external characteristics are very different, all are but variations of a single plan, which exists as the basis of all, and is varied in each individual only so as to accommodate it to the conditions under which the individual is to live. The germ of a higher animal—a mammifer, for instance—is the representative of a lower animal full-grown, like the *volvox globator*; the latter remaining in this initial stage, as an animalcule, through its whole existence; while the former is developed out of it, by successive stages, into a quadruped, or even into a man. Similar functions are performed in different animals by very different organs, the gills of fishes performing the same office as the lungs of the mammalia; and these different organs sometimes exist, at different periods, according to the degree of development, in the same animal. Thus, the tadpole, so long as it continues to be a fish, breathes by gills, which disappear and give place to lungs when it becomes a frog. Similar transformations of the insect tribe are familiar to all. Imperfect or rudimentary organs are found in certain animals, as the mammæ of a man; a particular organ being here developed to a certain extent,

though it is not needed ; but being developed a little further, it becomes useful in the next set of animals in the scale. The same peculiarity is found among plants ; the skilful gardener being able actually to develop these rudimentary organs by supplying the requisite conditions, and thus, as it were, to raise the plant one step in the scale.

“ We have yet to advert to the most interesting class of facts connected with the laws of organic development. It is only in recent times that physiologists have observed that each animal passes, in the course of its germinal history, through a series of changes resembling the *permanent forms* of the various orders of animals inferior to it in the scale. Thus, for instance, an insect, standing at the head of the articulated animals, is, in the larva state, a true annelid, or worm, the annelida being the lowest in the same class. The embryo of a crab resembles the perfect animal of the inferior order myriapoda, and passes through all the forms of transition which characterize the intermediate tribes of crustacea. The frog, for some time after its birth, is a fish with external gills and other organs, fitting it for an aquatic life, all of which are changed as it advances to maturity, and becomes a land animal. The mammifer only passes through still more stages, according to its higher place in the scale. Nor is man himself exempt from this law. His first form is that which is permanent in the animalcule. His organization gradually passes through conditions generally resembling a fish, a reptile, a bird, and the lower mammalia, before it attains its specific maturity. At one of the last stages of his foetal career, he exhibits an intermaxillary bone, which is characteristic of the perfect ape ; this is suppressed, and he may then be said to take leave of the simial type, and become a true human creature. Even, as we shall see, the varieties of his race are represented in the progressive development of an individual of the highest, before we see the adult Caucasian, the highest point yet attained in the animal scale.

“ To come to particular points of the organization. The brain of man, which exceeds that of all other animals in complexity of organization and fulness of development, is, at one early period, only ‘ a simple fold of nervous matter, with difficulty distinguishable into three parts, while a little tail-like prolongation towards the hinder parts, and which had been the first to appear, is the only representation of a spinal marrow. Now, in this state, it perfectly resembles the brain of an adult fish, thus assuming *in transitu* the form that in the fish is permanent. In a short time, however, the structure is become more complex, the parts more

distinct, the spinal marrow better marked ; it is now the brain of a reptile. The change continues ; by a singular motion, certain parts (*corpora quadragemina*), which had hitherto appeared on the upper surface, now pass towards the lower ; the former is their permanent situation in fishes and reptiles, the latter in birds and mammalia. This is another advance in the scale, but more remains yet to be done. The complication of the organ increases ; cavities, termed *ventricles*, are formed, which do not exist in fishes, reptiles, or birds ; curiously organized parts, such as the *corpora striata*, are added ; it is now the brain of the mammalia. Its last and final change alone seems wanting, — that which shall render it the brain of man.' — pp. 150 – 152.

Usually, it is true, each species produces only its like, — “every creeping thing and beast of the earth” bringing forth young “*after his kind*.” But the development of a single animal, under the ordinary law, takes place in a few weeks or days ; while the development of distinct races and species is the work of a whole creation, and is spread over countless ages. It is reasonable to suppose, that the latter is effected by means of a higher law, manifesting itself only at long intervals. Its infrequent manifestation is no argument against the regularity and necessity of its occurrence, — against its being a law at all. The comet that visits our system only once in five hundred years is controlled by the same inflexible principle which causes the return of another comet once in five years. The conditions requisite for a development more perfect than usual, — that is, for the production of a new species, — instead of a new individual of the same species, may be fulfilled only at long intervals ; but when they are fulfilled, the result — the more perfect development — takes place as necessarily, as much by the virtue of law, as the more ordinary phenomenon of the propagation of one race. These conditions may be answered in the successive stages of improvement, through which the earth and its atmosphere pass, during the vast periods of time contemplated in geology. In the era of the old red-sandstone, for instance, there were no higher animals than fishes, because the atmosphere was highly charged with carbonic acid, and could not support respiration by lungs. When the air became purer, the gills were changed into the imperfect lungs of the amphibious tribes, such as the huge saurians and the frogs. Deprive these latter animals, in their lower stage, of

all access to the light, and they will not advance to their higher stage. Put a tadpole into a perforated box, and sink it to the bottom of a river, and the animal will never be perfected into a frog ; he will grow to an enormous size, but he will continue a tadpole.

We see, then, the process of an "organic creation by law," or by virtue of the inherent qualities of inorganic matter. The ordinary chemical affinities of different substances may draw them together into such compounds as albumen and fibrin, which are the proximate principles of organic tissues. The action of electricity, heat, light, or some other mysterious imponderable agent, on these proximate principles, may produce globules, or germinal vesicles. These germs, multiplying themselves by fissiparous generation, will constitute a stock of animals of a low type, such as a tribe of infusory animalcules. Then "this simplest and most primitive type, under a law to which that of like production is subordinate, gives birth to the type next above it, this again produces the next higher, and so on to the very highest, the stages of advance being in all cases very small, — namely, from one species only to another ; so that the phenomenon has always been of a simple and modest character." Thus, the first reptile was born from a fish, the first bird was generated by a reptile, and the first mammifer had birds for its parents. The transformations appear rather astounding, as we pass from one class to another ; but the difference between the species, even, is often so great, that the transition appears hardly less difficult. In what quadruped, for instance, do we find the first ancestor of the huge and sagacious elephant ? What humble lizard gave birth to those monsters of the fossil world, the plesiosaurus and megalosaurus, thirty or forty feet in length ? Man, of course, upon this theory, is only a more perfectly developed monkey, or chimpanzee. With a nod of approbation to Lord Monboddo's theory, our author observes, that man has even the rudiments of "a caudal extremity" in the *os coccygis*.

That the instinct of animals and the mind of man are the results of nothing but material organization is an obvious corollary from this doctrine. "The difference," says this writer, "between mind in the lower animals and in man is a difference in degree only ; it is not a specific difference." Mental phenomena, apparently so various and unstable in

the individual, are reduced at once to regularity, and become subject to calculation, if considered in the mass. This shows, that, like the phenomena of the weather, they are under the presidency of natural laws. The phrenologists are the only persons who have followed the order of nature in the study of mind ; they have even determined the functions of the different parts of the brain. An experiment is mentioned with a newly killed animal, whose brain was taken out and its place filled with substances producing electric action, when the process of digestion, that had been interrupted, was instantly resumed, thus "showing the absolute identity of the brain with a galvanic battery." The experiment of inducing muscular action in a corpse, by applying galvanism, is sufficiently well known. To borrow an illustration from Sidney Smith, it would seem, that, if we only knew to what organs of the brain to direct an electric current, an automaton, or a dead man, might be made to hold an argument, "at least as well as most country parsons."

A person who should hear for the first time this naked exposition of the writer's theory would be tempted at once to reject the whole, as too extravagant and absurd to deserve further notice. But he would be much mistaken in this conclusion. The theory is a very plausible one ; it is one of the best cosmogonies that the wit of man has ever framed. It is a revival of the old atheistic hypothesis,—the Epicurean doctrine of the formation of the universe by a fortuitous concourse of atoms,—with all the modifications and improvements that were rendered necessary by the discoveries of modern science. We call it an atheistic theory, because, though the writer supposes that primitive matter was first endowed *by divine power* with its mysterious qualities and capacities, this supposition is gratuitous and arbitrary, and only mars the simplicity of the scheme, and injures the consistency and coherence of the parts with each other. We can more easily believe that these qualities are necessarily inherent in the constitution of matter, forming a part of its very essence, just like the properties of impenetrability and extension, than that they subsequently developed themselves by forming myriads of intricate organizations, without further aid from the divine architect. If we can credit the hypothesis, that bricks and mortar came together of their own accord, and arranged

themselves into the first house meet for the habitation of man, we can very readily admit, also, that the bricks first assumed the proper shape, and mortar the proper tenacity and hardness, without the intervention of human labor and skill. If there is no need of a bricklayer, we may discard also the brick-maker.

Putting 'aside, therefore, this gratuitous addition to the theory, we come to examine the plausibility of the doctrine which assumes, that material atoms, constituted as they now are, are capable, without oversight or direction, of forming a universe like our own, and producing all the animated tribes which tenant it. In all the atheistic reasoning upon this subject, and especially in the work now before us, there is a constant confusion between *what may be*, for aught we know to the contrary, and *what is*, so far as we are able positively to determine it from our present means of observation and experiment ; between the *possibility* that is measured only by human ignorance, and the *probability* that is fairly inferred by the legitimate exercise of the understanding. Effects have unquestionably been produced, such as the formation of a solar system, and the production of new and perfectly distinct orders of being, which we are wholly unable to account for by the *present and ordinary* operation of what are called secondary causes. If a theorist chooses to assume, that these secondary causes, under certain conditions, which we never have seen, and never can see, realized, might produce very extraordinary results, might even fully account for the wonderful effects in question, we have a right to say, in reply, that he is dealing in pure speculation and hypothesis ; that, having had no experience under the conditions or postulates of his theory, he is necessarily *speaking from* ignorance and *appealing to* ignorance ; that, even if we could not point out a single difficulty, a single false assumption, in his whole scheme and argument, it would still remain a mere hypothesis, alike incapable of proof or disproof ; and that, at the best, the arguments brought against it must be of nearly the same wiredrawn, speculative, and far-fetched character with those adduced in its support. On a mere sandbank, unsupplied either with arms or tools, the only edifice that can be built is one of sand, and sand affords the only means for its destruction. The fallacy to which such speculatists constantly have resort is, that the weakness or the entire absence

of all considerations against their theory constitutes a positive argument in its support. No such thing ; it affords only a fair presumption of the baseless character of the whole fabric.

This may be made more clear by examples. If a child, who has had little experience of the laws of nature, and has learned nothing from books, is gravely assured by his instructor, that in a distant region of the ocean there is an island where stones fly upward instead of downward, and men walk on their heads instead of their feet, the young philosopher, however acute and ingenious we may suppose him to be, certainly could not offer one valid argument against the alleged fact. He could only stare, and wonder, and say that it might be so *for all that he knew to the contrary*. Just so, when the atheist tells us, that far off in infinite space is a region, of which we can see nothing, even with our best telescopes, except a faint glimmer of light, floating like a cloudlet in the heavens, where the primitive atoms of matter, directed by gravity alone, are slowly congregating together, and forming suns, and planets, and secondary satellites, and giving birth to such intricate harmonies of mutually dependent and revolving worlds as those which have prevailed for ages in our own system ; or that, thousands of years ago, the same unassisted laws of matter, which we now see producing only such comparatively meagre and insufficient results, actually caused animalcules to be produced from pure sand, and fishes to be created out of oysters, and birds to be generated by slimy and grovelling reptiles, and men to be born from monkeys ;—if he should tell us all this, certainly we could offer no direct confutation of the wonderful tale. In regard to alleged facts of this character, the wisest of men are, and always must be, mere children. But it would be monstrous to say, that this wild assertion derived any support from their admitted bewilderment and incapacity. This would be to attempt to found knowledge upon ignorance. The dim analogies resting on questionable facts, the bold assumptions and slippery arguments on which such daring hypotheses must be based, can be refuted, for the most part, only by reasoning in kind, — by arguments nearly as uncertain, it may be, as those which they are brought to answer. We cannot *prove* a negative ; we can only show the insufficiency of the ground on which the opposite assumption is made to

rest ; and enough is done for this end, when it is made to appear, that the whole scheme is a *mere* hypothesis.

We make these general remarks only to relieve some readers of this volume from the doubt and perplexity which its perusal may have caused, solely because they were unable to detect any one glaring fallacy or inconsistency in the writer's theory. It appears plausible enough ; for, though there is very little in its favor, it seems at first sight as if there was little or nothing to say against it. On closer scrutiny, it will be found, perhaps, that it is disproved by a multitude of considerations, any one of which would be fatal to it ; as the hypothesis is of such a character, that, when a single breach is made in it, the whole edifice must tumble. If the intervention of an extraneous cause be absolutely necessary at any one stage or process in the creation, it may as well be admitted in all ; the principle must be given up, and the whole purpose of the theist is answered. We shall endeavour to show that this hypothetical history of creation is not only faulty in every point, when viewed from the author's own ground, but, when examined in the proper direction, is absolutely unintelligible, or is in fact no history at all.

Let us look first at the nebular hypothesis. Certain spots and tracts in the heavens, of a whitish color, appearing to the naked eye to be *nebulæ*, on being examined through a telescope, instantly resolve themselves into a multitude of distinct and perfectly formed stars. Such is the greatest nebula of all,—the galaxy, or milky way. Other spots of a like character, if viewed through glasses of moderate power, still appear as *nebulæ* ; but when seen through more perfect instruments, they immediately seem, like the others, to be a mere crowd of stars. Others, again, are not separated or resolved by the best telescopes ; but what is the natural inference from this fact ? Surely, we infer that they are merely crowded collections of stars, just like the others, except that they are too distant or too small to be seen as distinct bodies, even with the most powerful instruments that we possess. If telescopes of a greater range should hereafter be constructed, there is every reason to believe that these also will be resolved to the eye into their component parts as stars ; and in fact, if newspaper accounts may be credited, when Lord Rosse's new and magnificent telescope was first turned towards some of these spots, which had

always preserved their nebulous appearance when examined by inferior instruments, it was immediately apparent, that they were composed of distinct stars. Yet the hypothesis we are now considering assumes, that these remote and faintly seen nebulae are not crowds of stars, but primitive luminous matter, the particles of which are slowly congregating together, and forming one new star, or several. Certainly, never was a bold theory built upon a narrower basis. It is due, however, to the two Herschels, the chief supporters of this theory, to say, that they have always spoken of it only as a hypothesis, and by no means as an established fact in astronomical science. And, as a hypothesis, it labors under this peculiar difficulty, that it evidently never can be verified. It must ever remain a *mere* guess, directly opposed by an obvious induction from those nebulae which are resolvable into perfect stars.

The fact, that one or two bright points, assumed to be centres of aggregation, are seen in some of these nebulae, is of no importance. If a bright star be seen from this earth in the same line of vision with the nebula, it will be projected on the ground of that nebula, and will appear as a part of it, though it may be many millions of miles on this side, and have no more connection with it than the planet Jupiter would have, if it should happen to be in conjunction with the nebula, and thus appear for a short time to be projected upon its disc.

There is one consideration of some weight, though we have never seen it adverted to, which tends directly to confute the nebular hypothesis. That faint radiance called the zodiacal light, which is seen to stream up in the form of a cone from our sun, is assumed by our author to be a residuum of the nebulous matter belonging to our system, which has not yet been drawn into the sun, though it is on its way thither. Others have supposed, with far more probability, that it is the sun's atmosphere, and therefore its present shape and size will never change,—as they never have changed, during the period in which they have been observed by man. But no matter; we are now reasoning upon our author's hypothesis. If the zodiacal light be composed of primitive nebulous matter, it must now be comparatively thick and dense, since the process of aggregation has been going on for countless ages, and, in our system, is considered

as nearly completed ; just as when a sediment is forming in a tumbler full of turbid water, after the upper portion of the fluid has become entirely clear, there will be a stratum of water next to the sediment more turbid than the whole was before the deposition began. Yet this light is very faint, when seen only from the distance of our earth ; and at the boundaries of our system, from the orbit of Uranus, for instance, we cannot believe that it is visible at all. Is it likely, then, that a portion of this nebulous matter, in which the process of deposition has hardly begun, and which is seen from a distance so vast, that in comparison with it the whole diameter of our solar system is but a point, would be visible from this earth ? In the case of the other nebulæ, a multitude of perfectly formed suns, uniting their respective beams, are seen only as a faint, whitish speck on the blue arch. And yet we are required to believe, that the luminous matter which will ultimately form but one sun, or perhaps two, while still thinly diffused over an immense tract of space, the process of aggregation having hardly commenced, is yet visible to our eyes at this vast distance.

" Credat Judæus Apella ;
Non ego."

We pass to the next chapter in the history, which professes to explain the gradual formation of a solar system by a process of cooling and shrinking, to which the central orb is exposed. And here we are met by a difficulty at the outset ; for the existence of comets with their very eccentric orbits is wholly irreconcilable with the theory. At their perihelion, many of these bodies pass within the orbit of Mercury, while the aphelion of some lies without the path of Uranus. Where were they, when the body of the sun filled up the whole of the vast sphere circumscribed by the orbit of the remotest planet ? If we suppose that they are late comers, after the rest of our system was perfected, — that they were generated by themselves in distant regions of space, and, having strayed about, orphan-like, for a while, they accidentally crossed our track, and were taken as adopted children into our family, another question remains to be answered. Why did they not remain in their first position, absorb their full share of nebulous matter, beget a respectable family of planets, and take rank as chiefs of their own clan ? These comparatively anomalous bodies are great stumbling-blocks for the *soi-disant* historians of creation.

Again, if an immense orb be formed, the parts of which cohere strongly enough for the whole to turn upon its axis as one body, the process of cooling can go on only from the surface. A crust may finally be formed there ; but we see not how the refrigeration and shrinking of the interior parts can then go on separately, until the mass in the centre finally becomes detached from its envelope, like a shrivelled nut from its shell. Our earth is cooling down at this moment, unless the warmth which it receives from the sun exactly counterbalances the loss by radiation of internal heat. But the exterior and interior do not cool by different radiations, nor is there, so far as we know, the least tendency in the central mass to shrink separately, so as to detach itself from the surrounding crust. As deep as we can penetrate towards the centre, we find the heat regularly increase, — just as we might expect, if the only absolute loss of heat be from the surface.

If the matter now concentrated in the sun, and that which forms the several planets with their secondaries, were all moulded into one mass, and then dilated so as to fill the vast sphere of which the orbit of Uranus forms a circumference, the substance would evidently be in a state of extreme tenuity and diffusion. Immense as the mass of the sun now is, it is but a mere nut at the centre of the grand globe which we are now considering. Expanded to such vast dimensions, we cannot conceive of it as a solid spheroid turning upon its axis, but only as a mass of fluid or vapor, in which a circular motion would generate only vortices or whirlwinds. In such an aggregation of subtile matter, no crust could be solidified on the outer ring, and then detached from the mass within ; indeed, any separation of the parts under such circumstances is inconceivable. Even a rotary motion could not be established in it, except by an impulse received from without ; for there is every reason to believe, that the movement of a homogeneous fluid towards its centre, if it could take place without disturbing causes, would be in radial lines, and not in a spiral.

Our author brings into view all the mathematical proportions and uniform relations which exist between the constituent bodies of the solar system, in order to indicate the probability of their formation from the constant working of one material cause. Thus he remarks, that the primary

planets all move nearly in one plane, and "show a progressive increase of bulk and diminution of density, from the one nearest to the sun to that which is most distant." But he passes over other characteristics of these bodies, equally important, which are quite irregular, and cannot be traced to the operation of one law. Compare the periods of rotation on their respective axes, and we find no correspondence, no indication that the revolving motion was imparted to all by one inflexible law. The first four planets, counting from the sun, perform their rotation in nearly the same time, namely, twenty-four hours. But Jupiter's period is a little less, and Saturn's a little more, than ten hours. Again, Jupiter's axis of rotation is nearly perpendicular to the plane of the ecliptic, while that of Mars is inclined at an angle of fifty-nine degrees forty-two minutes. Another irregularity, still more fatal to the theory, is found in the number of satellites by which the respective planets are attended. Saturn has seven, beside the two rings; Jupiter has four, Mars has none, and the earth has but one. On the single hypothesis, that our system was formed by rings successively thrown off from a central body by a process of refrigeration and contraction, these irregularities are inexplicable. Mars, it seems, did not shrink at all, while Jupiter cast off four separate rings, and the earth produced its single moon. The distances of these bodies from their primaries are also quite irregular; in the case of Jupiter, the outermost of the satellites revolves at a distance which is only twenty-seven times the radius of the primary, and the innermost is distant but six times that radius. This planet, consequently, has shrunk to one twenty-seventh part of its original diameter, and in so doing, has formed four moons; the earth has shrunk to one sixtieth part of its first diameter, and still has produced but one satellite. If the same law had prevailed in the two cases, we ought to have nine or ten moons.

We need not analyze with any great minuteness the geological facts and hypotheses incorporated into this magnificent history of creation. As will be seen hereafter, the violent and sweeping transformations and convulsions that the earth's crust has undergone directly conflict with our author's theory, and afford the strongest presumption, that an extraneous cause has frequently interfered, at different periods, to repair the desolation produced by the unassisted working of

natural laws, to bring order out of chaos, and to people the desert earth anew with animated tribes. The only general fact of much moment, which our author has drawn from the discoveries of geologists, for the confirmation of his own hypothesis, is, according to his own account, one of the most questionable doctrines in the whole science, — one of a negative character, on which we can never rely with full assurance, till the researches of man have probed every fold, and examined every thread in the texture, of the earth's garment, and thus shown that no evidence can possibly be discovered to the contrary. The alleged fact is, that, in the early formations of rock — the first pages in the history of the earth's surface — are found the remains of animals and vegetables only of the lowest type and most imperfect development; while, in the later strata, forms more and more advanced are discovered; so that there seems to have been a constant progress along the line leading to the higher forms of organization. The testimony which goes to support this assertion is wholly negative. The geologist reasons thus: The more perfect organisms have not been discovered in the earlier strata; *therefore*, they do not exist in them. When, in a different connection, it suits our author's purpose to throw doubt on the very postulate which is here admitted, he holds the following language.

"These, it must be owned, are less strong traces of the birds than we possess of the reptiles and other tribes; but it must be remembered, that the evidence of fossils, as to the absence of any class of animals from a certain period of the earth's history, can never be considered as more than negative. Animals, of which we find no remains in a particular formation, may, nevertheless, have lived at the time, and it may have only been from unfavorable circumstances that their remains have not been preserved for our inspection. The single circumstance of their being little liable to be carried down into seas might be the cause of their non-appearance in our quarries." — p. 95.

In truth, the researches of geologists are every day bringing to light new facts, which compel them to modify or abandon many of the positions they formerly held; so that a considerable portion of the science is a mere quicksand of shifting theories. We need only allude to the various suppositions respecting the origin of drift, and to the numerous modifications of the glacial theory. Important discoveries have been

made within a short time, showing that certain animal tribes had their origin much farther back than was at first supposed. A few years ago, reptiles were believed to be the highest type of life that existed during the era of the new red sandstone. But Professor Hitchcock's recent discovery in this stone of the footprints of gigantic birds has added a higher class to the zoölogy of the period ; and within a few months, in the same red sandstone of the Connecticut valley, tracks of two or three species of quadrupeds have been found, some of them being probably mammifers of a lower grade. It is true, no fossil remains of these animals have been brought to light ; but this want only renders the discovery more significant for our present purpose. It shows that certain animals must have lived at the period in question, though their remains have not yet been found ; and from the greater age of the rocks then formed, and the consequent greater number of convulsions of the earth's surface to which they have been subjected, these remains may have entirely disappeared. It is a curious fact, also, that the animal remains of that period, which have come down to us, belong to genera so constituted, that their bodies might well survive, if we may so speak, the shocks which would have destroyed every trace of some more delicate, or more finely organized, beings. We find remains of the flint-shielded animalcules, the hard-shelled mollusca, and the cartilaginous fishes ; but the bodies of mammalia, birds, and even the higher species of fishes, some of which we may suppose to have been more tender and corruptible, have utterly perished. Here and there, an individual of their number left the print of its foot on the sand, which subsequently hardened into rock, and brought down to our times a faint vestige of its past existence.

We are not attempting to impugn the credit of geological science in general, which would be a wholly futile task. The multitude of facts respecting the present constitution of the earth's crust, recently made known by laborers in this department, are among the most curious and most pregnant discoveries of modern times. But when we come to the formation of theories respecting the past history of the earth, in order to account for the phenomena at present visible on its surface, we are evidently afloat on a sea of conjecture, each hypothesis being valid only till a more plausible one is proposed, — which happens very frequently, — or till it is ef-

fectually disproved by some new discovery in the rocky strata. A fertile imagination and a bold face are among the most striking traits of our more daring geologists. Grant to one of this character a few modest postulates, — give him certain millions of years, a sufficient number of earthquakes, a whole battery of volcanoes, a few ocean deluges, and the rise and fall of half a dozen continents, — and he will frame a theory off-hand, which will account for the most perplexing phenomena. Our author is certainly entitled to take his place at the very head of this class of speculatists.

In accounting for the work of creation by the natural and unassisted development of the inherent qualities of brute matter, the great difficulty is found at the first link in the chain of animated being. How can we explain the commencement of *life*? We must have a clear idea of the whole scope of this problem, before we can make any attempt at its solution. Life, then, is *not* mere organization, though most materialists, philosophers, like our author, willingly confound the two things; to hear them reason, one would almost suppose that there was no difference between a dead man and a living one. Organization is subservient to life, ministers to it, manifests it, — supports it, if you please, — but does not constitute it. He must be a bolder man than we are, who will undertake to say *what it is*; but we can very safely declare *what it is not*; and in any particular form or aggregation of matter, whether organic or inorganic, we can give a shrewd guess as to its presence or absence. It may be said, that we beg the question by assuming that organization is not life; it may be so; but it is quite too much to allow the materialist quietly to take the opposite doctrine for granted. He must know the full extent of his task, — that it is necessary for him not only to construct the machine, but actually to set it in motion, so that it shall afterwards run on of its own accord. It is very easy to frame a partial definition of life, by merely describing one or two of its characteristic functions; and then, because some action can be detected between the particles of brute matter, which resembles the exercise of these functions, boldly to declare that the whole mystery is solved. Thus it is said, that life is nothing but the accretion of similar substances, or the addition of like unto like; and as this occurs in crystallization, which is confessedly a phenomenon of inorganic matter, therefore there is no fundamental difference

between the properties of living and dead substances. We deny the first proposition ; nutrition is not the only characteristic of life, and the nutritive process, whether in vegetables or animals, is not mere accretion, but assimilation. It has been said, though the assertion is by no means fully proved, that assimilation is only a finer kind of chemistry, the constituent principles being brought together only by their natural affinities. Even if this were true, if the stomach and the digestive apparatus were only a well furnished chemical laboratory, fit for conducting the most delicate experiments, the great difficulty would still remain. The question might yet be asked, Where is the chemist ? And this is the fundamental question, which the materialists never attempt to answer, but quietly evade.

The difference between an inorganic and an organic body has been explained by Coleridge clearly enough for our purpose. In the former, — a sheaf of corn, for instance, — the whole is nothing more than a collection of the individual parts ; in the latter, — an animal, — the whole is the effect of, or results from, the parts. In the latter case, the whole is every thing, and the parts are comparatively nothing. One of the great effects of life is to keep the parts in subjection to the whole, making them contribute to its support and growth, and thus maintaining the unity of the system. The stomach digests, the lungs inhale air, the heart beats, and the blood circulates ; and as the joint effect, or as the common supporter, — it matters not which, — of these operations, *life* continues, and the animated being is a unit ; it has not merely virtual, but essential unity. The reciprocal action of the respiratory, circulating, and nervous systems is absolutely necessary to life. The animal dies, and this unity, this subservience of the parts to the whole, immediately ceases. In the functions of the living body, it may be that the ordinary laws of chemistry are preserved, and that the elements of carbon, oxygen, and hydrogen combine and separate according to their ordinary affinities, and in no unusual proportions. But after death, at any rate, quite a different set of chemical laws come into play, and produce a result which is the very opposite of that before effected. There is no longer any unanimity or coöperation ; instead of sustaining or building up the animal tissues, the affinities now in operation tear down, destroy, and resolve them into their ultimate ele-

ments,—each part following out its own law of destruction or resolution, irrespectively of the others.

“There is in living organic matter a principle constantly in action, the operations of which are in accordance with a rational plan, so that the individual parts which it creates in the body are adapted to the design of the whole; and this it is which distinguishes organism. Kant says, ‘The cause of the particular mode of existence of each part of a living body resides in the whole, while in dead masses each part contains this cause within itself.’ This explains why a mere part separated from an organized whole generally does not continue to live; why, in fact, an organized body appears to be one and indivisible. And since the different parts of an organized body are heterogeneous members of one whole, and essential to its perfect state, the trunk cannot live after the loss of one of these parts.” — *Müller's Physiology*, Vol. I., p. 19.

The apparent exceptions to this statement—as in the case of the polypes, which multiply by fissiparous generation, or by spontaneous division of their bodies into parts, each part becoming a perfect animal—are only apparent. These creatures, which are low down in the scale of being, exemplify what Mr. Owen calls “the law of vegetative or irrelative repetition,” as they have many organs performing the same function, and not related to each other by combination for the performance of a higher function. Thus, a Polygastrian has many assimilative sacs, each performing the office of a stomach irrespectively of the rest. In the insect tribe, the respiratory function, instead of being performed by one set of lungs for the whole body, is carried on through a series of minute and highly ramified tubes, which traverse every part of the body, and open to the air by a great number of orifices. In some instances, both respiration and digestion seem to take place over the whole surface of the body; for Trembley found at least one case, in which the animal digested its food equally well, after it had been turned inside out. A number of similar parts being repeated in each segment of the individual, the body can be divided, and the several portions, each still containing some of all the organs essential to the whole, will continue to live separately. The severed parts will even continue to grow, and to develop other organs convenient for individual existence. But most animals, especially the more perfect, do not constitute an ag-

gregate of similar parts united by one trunk, and therefore propagation by division is in them impossible. The ovum, when separated from the parent, is an entire animal only *potentially*; during its development, the essential parts which constitute the *actual* whole are produced. In the case of the polype, we have only to suppose that the ovum remains connected with the parent being, till all, or nearly all, its essential parts are produced. It is then shed not as a mere ovum, but as an animal nearly or wholly complete.

Now, all the instances adduced by our author, to show similarity of action in the organic and the inorganic world, are irrelevant. The analogies are not merely imperfect; they are no analogies at all. Crystals increase by the aggregation of new particles on the external surfaces of the parts already formed; there is no consentaneous operation of the parts on the whole. The molecules of crystals are homogeneous throughout, and the several aggregates of these molecules are independent of each other; while organized bodies are composed of parts perfectly dissimilar from each other, but all of which conspire to one end. "The growth of organized bodies," says Müller, "takes place in all particles of their substance at the same time, while the increase of the mass in inorganic bodies is produced by external apposition." Frostwork on the windows may resemble vegetable *forms*; but it has no resemblance whatever to vegetable *life*. Electricity may counterfeit the *action of life*, for a moment, on a particular limb, by causing the muscles to twitch; but it does not counterfeit *life itself*, by causing all the parts again to contribute to the sustentation of the whole. A French chemist, by electric action, may have produced *globules* in albumen; there is nothing very wonderful in that; any one may blow bubbles in a viscid fluid. The resemblance between these globules and proper germinal vesicles amounts to nothing more than similarity of outward shape; there is no more real resemblance between them than between the oval lump of chalk which farmers sometimes put into a hen's nest, in order to deceive poor Dame Partlet, and the real egg which the hen deposits by the side of it. Certainly, the imponderable agents, heat, light, and electricity, are in some mysterious way *connected with* life, so as to contribute to its support; there is nothing more in this assertion than in the familiar proposition, that a seed will germinate only under the

proper conditions of soil and climate ; but that these agents, acting on inorganic matter, ever *create* or *commence* life is a pure hypothesis, not supported even by the shadow of a fact.

Having thus shown how weak are the general considerations in favor of the theory, that animated beings may be created out of inorganic matter by mere natural laws, we should proceed to consider the direct evidence adduced to prove that life has actually been produced in this way. Here the whole question is opened respecting the alleged instances of equivocal generation, and we have neither space nor ability to discuss them at length. Those who are curious respecting the question may find a brief summary of the evidence on both sides in a former number of this Journal.* We can mention only a few facts and arguments, which show the extreme improbability of the doctrine supported by our author and a few other theorists.

In the first place, it is remarkable, that all the races of animated beings, which are entirely within the range of our powers of observation, — which have such a size and locality that we can study and accurately determine their organization and habits, — are unquestionably produced from parents of their own kind. Only the minute microscopic animals are now supposed to be generated spontaneously ; and this alleged fact rests not on direct proof, but only on our inability in certain cases to trace the process of their production in the ordinary way. As many of these animals, in their perfect state, are not more than the twelve thousandth part of an inch in diameter, it is not much to be wondered at, that we should not be able in all cases to discover their ova, or to follow these ova through all their stages of development into the complete being. It is farther remarkable, that these animalcules, when once produced, whether by spontaneous or natural generation, are all found to be provided with the organs or requisite means for continuing their species, and, in fact, for multiplying their number from themselves with astonishing rapidity. As they certainly have children, it seems reasonable to suppose, according to the analogy of all the higher animated tribes, that they also had parents. The ancients supposed, that the worms and insects which appear

* *N. A. Review*, Vol. LVI., pp. 339 — 351.

in decaying organic matter were generated there by the decomposition of the substance, without the previous agency of individuals of the same stock. Every schoolboy is acquainted with Virgil's mode of obtaining a new swarm of bees from the decaying carcass of a heifer. Subsequent researches, made with more care, and perhaps with better instruments of observation, have entirely disproved the hypothesis, and show that the maggots were produced in every case from eggs deposited by flies or other insects, and were afterwards themselves developed into the state of perfect insects. Then it seems reasonable to believe, that the improved observations of future times will clear up the only remaining difficulty, and show how the infusory animalcules also are generated from beings of their own kind.

These minute creatures are prolific to a degree that transcends all calculation; and they exist, either in the egg or maturely developed, in inconceivable numbers. A single wheel-animalcule, *Hydatina senta*, which was watched for more than eighteen days, and which lives still longer, is capable of a fourfold increase in twenty-four or thirty hours; a rate of propagation which would afford in ten days a million of beings. From their tenacity of life, extraordinary powers of reproduction, and incalculable numbers, their united influence may be said to be far more important, in all the great operations of nature, than that of the larger and more perfectly developed organisms. They swarm in all the seas, and play an important part in choking up harbours and forming great deposits at the mouths of rivers. The remains of those which have perished form great beds and strata in the crust of the earth. The silicious stone, called Tripoli, is entirely composed of such remains; at Bilin, in Bohemia, there is one stratum of this substance, fourteen feet thick, one cubic inch of which is estimated to contain forty-one thousand millions of individuals. Their extreme tenacity of life is evinced by the fact, that many of them may be entirely desiccated, and preserved in pure sand for several years, after which, on the application of a drop of water, they may be restored to life. In this dried state, M. Doyère exposed some of them to a heat equal to that of boiling water, and afterwards revived them; though, in an active state, if subjected to a much lower temperature, they perish. If, then, the fully developed and mature can resist such powerful ex-

traneous causes of destruction, how much more must the ova possess the power of enduring them without losing their latent life ! The following extract from Professor Owen's Lectures shows the bearing of these facts upon the question of equivocal generation.

"The act of oviparous generation, that sending forth of countless ova through the fatal laceration or dissolution of the parent's body, is most commonly observed in the well-fed *Polygastria*, which crowd together as their little ocean evaporates ; and thus each leaves, by the last act of its life, the means of perpetuating and diffusing its species by thousands of fertile germs. When the once thickly tenanted pool is dried up, and its bottom converted into a layer of dust, these inconceivably minute and light ova will be raised with the dust by the first puff of wind, diffused through the atmosphere, and may there remain long suspended ; forming, perhaps, their share of the particles which we see flickering in the sunbeam, ready to fall into any collection of water, beaten down by every summer shower into the streams or pools which receive or may be formed by such showers, and, by virtue of their tenacity of life, ready to develope themselves wherever they may find the requisite conditions for their existence.

"The possibility, or, rather, the high probability, that such is the design of the oviparous generation of the *Infusoria*, and such the common mode of the diffusion of their ova, renders the hypothesis of equivocal generation, which has been so frequently invoked to explain their origin in new-formed natural or artificial infusions, quite gratuitous. If organs of generation might, at first sight, seem superfluous in creatures propagating their kind by gemmation and spontaneous fission, equivocal generation is surely still less required to explain the origin of beings so richly provided with the ordinary and recognized modes of propagation."— pp. 31, 32.

Recent accounts show, that the dust collected from the atmosphere at sea, many miles from land, generally contains some of these dried animalcules and their ova. Many of these germs can be developed only in particular localities, or under certain conditions which are rarely fulfilled. Consequently, if there were but few of them, the species might perish, because those few might not find their appropriate home. But such an accident is guarded against by the vast multiplication of these germs and their wide dispersion ; for, unlike all the higher tribes of beings except man, the same species is often found in all regions of the globe. Very few, in comparison with the whole number, may find a proper *nidus* ; but these

few then propagate with such marvellous rapidity, as fully to replenish, if not to increase, the original stock. Thus they have been enabled, as species, to survive even those destroying causes which exterminated all the higher forms of animals. Several species still exist, which were in being at the time of the cretaceous formation, though all the other animated races belonging to that period have perished. "These animalcules," says Ehrenberg, "constitute a chain, which, though in the individual it be microscopic, yet in the mass is a mighty one, connecting the organic life of distant ages of the earth."

In view of facts like these, we may surely say, that the existence of the infusory animalcules, and even of the entozoa, is conceivable, supposing they could only have been produced by parents of their own kind, and without having recourse to the anomalous and hypothetical doctrine of equivocal generation. We may not be able to trace their line of parentage, for our imperfect vision cannot follow the notes which play in the sunbeam, nor track them from their birth-place to their final home. But we know that they must be deposited in every layer of dust that falls from the atmosphere, that they must be inhaled with every breath which an animal draws, and be swallowed with every morsel and drop of its food. The experiments which seem to prove that living beings may be produced from pure inorganic matter are all explicable on the supposition, that adequate precautions were not taken to exclude every animal and germ capable of development from the substances experimented upon, and from the air which was admitted into the apparatus. On this ground, the experiments of Crosse and Weekes, cited by our author, have been quite generally rejected by scientific men, as hardly deserving of notice. We learn that the former was "discouraged by the reception of his experiments," and "soon discontinued them"; — with good reason, for it does not appear from our author's account, that he adopted any precautions at all. Mr. Weekes seems to have been a little more cautious, and the consequence was, that he did not observe any appearance of life among the substances experimented upon for "eleven months," at the end of which time we may reasonably suppose, that his precautions ceased to have perfect effect. The only experiment, in which adequate means to guard against causes of error were taken, was

that of Professor Schulze, of Berlin, which had a contrary result. We extract Mr. Owen's account of it.

"He filled a glass flask half full of distilled water, in which were various animal and vegetable substances: he then closed it with a good cork, through which were passed two glass tubes, bent at right angles, the whole being air-tight: it was next placed in a sand bath, and heated until the water boiled violently. While the watery vapor was escaping by the glass tubes, the Professor fastened at each end an apparatus which chemists employ for collecting carbonic acid: that at the one end was filled with concentrated sulphuric acid, and the other with a solution of potash. By means of the boiling heat, it is to be presumed that every thing living, and all germs in the flask or in the tubes were destroyed; whilst all access was cut off by the sulphuric acid on the one side, and by the potash on the other. The apparatus was then exposed to the influence of summer light and heat; at the same time, there was placed near it an open vessel, with the same substances that had been introduced into the flask, and also after having subjected them to a boiling temperature. In order to renew constantly the air within the flask, the experimenter sucked with his mouth several times a day the open end of the apparatus, filled with the solution of potash, by which process the air entered his mouth from the flask through the caustic liquid, and the atmospheric air from without entered the flask through the sulphuric acid. The air was of course not at all altered in its composition by passing through the sulphuric acid in the flask; but all the portions of living matter, or of matter capable of becoming animated, were taken up by the sulphuric acid and destroyed. From the 28th of May until the beginning of August, Professor Schulze continued uninterruptedly the renewal of the air in the flask, without being able, by the aid of the microscope, to discover any living animal or vegetable substance; although, during the whole of the time, observations were made almost daily on the edge of the liquid; and when, at last, the Professor separated the different parts of the apparatus, he could not find in the whole liquid the slightest trace of *Infusoria* or *Conserva*, or of mould; but all three presented themselves in great abundance a few days after he had left the flask standing open. The vessel which he placed near the apparatus contained on the following day *Vibriones* and *Monads*, to which were soon added larger Polygastric *Infusoria*, and afterwards *Rotifera*." — pp. 32, 33.

For readers who are not familiar with these subjects, it may be well to mention, that the weight of authority is decidedly against this doctrine of spontaneous generation. It is

rejected by Müller, who ranks among the first physiologists of Germany ; by Ehrenberg, one of the most distinguished microscopists in the world ; and by Owen, who stands at the head of the school of comparative anatomy in England, if not in Europe. The remark made by Cuvier, more than thirty years ago, is still true at the present day, that, "although the impossibility of spontaneous generation cannot be absolutely demonstrated, yet all the efforts of those physiologists who believe in the possibility of it have not succeeded in showing us a single instance."

Passing over, then, our author's theory of the origination of life from inorganic matter as utterly untenable, we come to the next point in his system,—the most chimerical of all,—the gradual development of the higher orders of being out of those next beneath them in the scale. It is not pretended, that there is *any known instance* of the transmutation of species, or of the evolution, in the ordinary way, of any being specifically different from its parents. The same animal, indeed, may pass through different grades of development ; but these changes affect only the individual, not the race. The progeny of this animal must begin at the same point where its parent did, and run precisely the same cycle. The tadpole becomes a frog, but the young of that frog are tadpoles ; the worm becomes a winged insect, but the eggs of that insect are hatched into nothing but worms. These changes in the life of the individual, like the successive periods of the embryotic state, of infancy, and manhood in the human being, are perfectly consistent with persistence of type in the race, and do not indicate even the possibility that a new species may be developed out of an old one. On the contrary, the germ must be considered as *potentially* equivalent to the whole future being, for it is invariably developed into that being. If there be any one fact unquestionably established by observation, it is that each species invariably produces its like. "All the phenomena," says Müller, "at present observed in the animal kingdom, seem to prove that the species were originally created distinct, and independent of each other. There is no remote possibility of one species being produced from another."

The doctrine of our author, then, is confessedly a pure hypothesis, and, as such, it might be summarily dismissed into the region of cloud-land and dreams, where it had its

origin. The burden of proof is upon him, and as he has failed to produce a single instance in which his theory is exemplified, he may be rightfully debarred the privilege of discussion. But waiving this point, if we look into the grounds of his conjecture, we find bold assumptions more than once substituted for the plain statement of facts, which would destroy every shade of credibility in his doctrine. True, there is an appearance, both in the animal and vegetable kingdoms, of an ascending scale of being, from simply organized forms and imperfect developments up to the complex arrangements and nice adaptations of the advanced tribes. But the progress is not regular, nor are the intervals of constant length. The line is often broken and doubled, and, in fact, the individuals are far more naturally arranged in a number of parallel lines, beginning successively at a somewhat lower point, than in a single series. Man, of course, is placed at the head of the animal tribes ; but the interval which separates him from the chimpanzee cannot easily be cleared at one bound. He forms but one genus, and that genus is the only one of its order. But even if the line of gradation were single and perfect, the fact would be of no service to the hypothesis we are now considering ; for the interval between two species most nearly allied to each other seems to be quite as impassable as the broadest gulf of separation.

The point chiefly relied upon to show the credibility of this doctrine is the fact, according to our author, that the higher animals pass through a series of changes resembling the permanent forms of the lower tribes. The first form of man himself "is that which is permanent in the animalcule"; and thence he comes to resemble successively a fish, a reptile, a bird, and the lower mammifers, before he attains his specific maturity. It is held, then, that a premature birth from an animal of a higher kind might have instituted a new race of a lower type ; and that a birth unusually delayed, permitting an embryo to be still farther advanced in the line of organization, might have created a new species of a higher order than the parent. Here, every thing depends on the *absolute identity* of the germs of all animals, in the lower stages of their growth. General resemblances and analogies are of no weight whatever ; the essential internal organization of the ova of different species must be the same ; otherwise, however ripened into a mature being, whether the birth be

advanced or postponed, the individual must still belong to its parents' species, of which it possesses the distinctive peculiarity. Now, this point of *the identity of germs is a mere assumption*; not only is it destitute of proof, — the whole evidence is against it. There is a degree of outward resemblance, but there is no sameness. When we trace the origin of life back to the remotest point to which our powers of observation extend, when we come to microscopic vesicles that can be discerned only by the highest magnifiers, general similarity of outward shape is all that can be predicated of them. The specific differences lie below this general resemblance of outward form; we cannot discern them, but we *know* that they must exist, and that they are *essential* differences, for each one of these vesicles is invariably developed, if at all, into an individual of the species to which its parent belongs. The germinal vesicles of a tree and a quadruped are somewhat alike, outwardly; so, to the hen's eyes, there is no difference between her own eggs and the duck's eggs which the farmer's wife has put into her nest. But when she has hatched her brood, part of them are found to be web-footed, and these, to her great astonishment and distress, immediately take to the water. Our author commits the same blunder as the poor hen. This want of consciousness that he has got to the end of his tether, this inability to believe that any difference can exist where he is not able to see it, though it is invariably indicated by future consequent differences of the most striking nature, is perfectly characteristic of the rash theorist in science.

The assertion, that man's "first form is that which is permanent in the animalcule," — even if we do not look to the potentiality of development into a higher being, which experience shows to exist in the human germ, but not in the infusorial, — is a positive misstatement. The lowest monad has a mouth and means for propagating its kind, which do not belong to the primitive ovum of any higher animal. About the succeeding stages in the growth of the embryo our author's language is more cautious. He only says, that they *resemble*, or *typify*, some of the lower orders of being; and this is virtually admitting a specific difference, and giving up his own theory for all the conditions posterior to that of the germ. The brain and heart of the embryo successively *resemble* the corresponding organs in a fish, a reptile, a bird,

and a quadruped ; but they are not identical, *even in outward appearance*, with those organs. Of course, if arrested at any stage of its growth, and prematurely born, the embryo would not be one of the lower animals, but only something resembling it in outward shape ; and conversely, if it were possible for the birth of a bird to be delayed till it had reached a higher stage of development in the same line in which it was proceeding, it would not become a quadruped, but it would be an anomalous creature somewhat like one. Consequently, no one species now on the earth can have been evolved out of any other existing race ; because the germs of any two, at a very early stage in their history, according to our author's own confession, are specifically unlike.

To avoid this difficulty, he is driven to a further supposition, still more gratuitous and improbable ; namely, that the germ destined to become one of a different race from its parents, having advanced along its usual line of development so far as that line coincides with the one belonging to the new species, there diverges, and follows a different path up to the period of its birth into a new creature ; that is, the embryo of a reptile, having grown for a certain time as if it were to be a reptile, suddenly turns aside, like a young man changing his mind about the choice of a profession, and for the rest of its foetal life follows the proper line of progress in order to be developed into a bird. This is mere dreaming, and reminds one only of the wonderful transformations effected by enchantment in an Arabian tale. We might just as plausibly suppose, that the reptile, after it became mature, was suddenly transformed into a bird, as that it underwent this change before it was hatched. All the evidence attainable goes to show, that the law of development is as immutable before as after birth, the several stages of progress succeeding each other in a constant order, and affecting the individual only, not the race. A young monkey is no more likely to be transmuted into a man than an old one ; nor is such a metamorphosis at all more probable in the course of its foetal life.

The view we have now obtained of the specific differences between distinct races of being at separate periods of their existence is precisely what might have been anticipated from the law of gradual development, which holds throughout the organic kingdoms. Between two mature animals, these

differences are perfectly obvious and well marked. As we go a step back in their history, the distinction becomes a little more obscure ; two worms may resemble each other very closely, though the two winged insects subsequently produced from them may be very unlike. Receding still farther, some of these specific differences may entirely disappear, the organs or parts which should exhibit them being not yet developed. And when we come to the primitive germs, so minute as to be visible only through the microscope, no outward distinction, perhaps, is any longer perceptible, and the radical difference of their internal organization is indicated only by the fact, to be verified by subsequent observation, that the two are invariably developed into perfectly distinct animals, belonging respectively to the same races with their parents. A theorist, whose whole system is based upon the invariable operation of natural agencies, cannot reasonably object to this conclusion.

That our statements in the course of this argument may not appear of the same questionable character as those advanced by our author, we will fortify them with a few brief citations from a work of such unquestionable authority as the Lectures of Professor Owen.

“ No doubt the minute infusoria, which seem to have their development arrested at the first or nearest stage from the primitive cell formation, offer close and striking analogies to the primitive cells out of which the higher animals and all their tissues are developed ; but the very [first] step which the infusoria take beyond the primitive cell stage invests them with a specific character as independent and distinct in its nature as that of the highest and most complicated organisms. No mere organic cell, destined for ulterior changes in a living organization, has a mouth armed with teeth, or provided with long tentacula ; I will not lay stress on the alimentary canal and appended stomachs, which many still regard as ‘ sub judice ’ ; but the endowment of distinct organs of generation, for propagating their kind by fertile ova, raises the polygastric infusoria much above the mere organic cell.” — pp. 25, 26.

“ In comparing the several stages in the very interesting development of the *cyanæa aurita* to the infusoria and polypes, it must be understood that such comparisons are warranted only by a similarity of outward form, and of the instruments of locomotion and prehension. The essential internal organization of the

persistent lower forms of the *zoöphyta* is entirely wanting in the transitory states of the higher ones. A progress through the inferior groups is sketched out, but no actual transmutation of species is effected. The young medusa, before it attains its destined condition of maturity, successively resembles, but never becomes, a polygastrian, a rotifer, and a bryozoon." — p. 112.

"Thus every animal in the course of its development typifies or represents some of the permanent forms of animals inferior to itself; but it does not represent all the inferior forms, nor acquire the organization of any of the forms which it transitorily represents. Had the animal kingdom formed, as was once supposed, a single and continuous chain of being, progressively ascending from the monad to the man, unity of organization might then have been demonstrated to the extent in which the theory has been maintained by the disciples of the Geoffroyan school." — p. 370.

If these similarities of structure in the germ had any bearing on the subject, they would indicate the possibility only of retrogression in the scale. Of course, the immature ovum, arrested in its development, could not form a more perfect being than its parent. There is no pretence that the embryo, at any stage of its progress, images an animal of a higher grade than its own family. Then what aid do these similarities of structure afford to the theory, that all the higher organisms have been evolved by successive steps out of the lowest monad? At the best, you have only shown, that a *retreat* is possible; you have still to point out any likelihood, even the remotest, of an *advance* in the scale of being. There is no fact whatever to confirm the supposition, that birth may possibly be delayed till the animal be developed into one of a higher species; and the law of immature births seems to be, that, if the offspring escapes at all, — for there is great risk consequent on such an accident, — it becomes as perfect as its progenitors. Nature seems to guard the distinctions between the several races with peculiar care; so far as we know, monsters either do not survive their birth, or are incapable of continuing their kind, or in the course of a single generation are reunited to the original family.

To say that these laws, distinct and invariable as far as the observation of man has extended, may possibly have been superseded in the lapse of ages by a higher principle, mani-

festing itself only at long intervals, is again to have recourse to a blank hypothesis, incapable alike of proof or disproof, and unsupported by the faintest intimations from the world of experience. To build up a theory in this way is not to account for the work of creation by the natural agencies and inherent qualities of matter, *as at present observable*, but to fly off to the wild supposition, that matter and life were more richly endowed ages ago than they are in our own day. You affirm, that this higher principle of development did not override the inferior laws at the earlier periods in time's history, because, in the infancy of the universe, the conditions were wanting which are requisite for its manifestation, — because the earth was not ready, the atmosphere was not purified, for the nobler races of being. Very well ; but these conditions are answered *now*. All things are ready at the present day for the innate energies of matter to put forth their utmost strength. Why do not fishes generate reptiles, and birds produce mammals, *now* ? Ah ! but “the earth being now supplied with both kinds of tenants in great abundance, we could only expect to find the life-originating power at work in some very special and extraordinary circumstances.” It seems, then, that these inherent qualities of matter, once supposed to be blind, absolute, and invariable in their operation, are really very judicious and reasonable ; they suit the supply to the demand, and actually cease working when the market is likely to be overstocked. The results of such “*natural agencies*” as these are very like the effects produced by the volitions of a wise and thinking being.

It happens that we are not obliged to grant to our author an indefinite lapse of ages for the sake of bringing all his higher principles into action. One of the latest events in the geological history of the earth was a great submersion of the land, by which “terrestrial animal life was extensively, if not universally, destroyed” ; so that the creation of the species now in being — at least, all the higher species — was “a comparatively recent event, and one posterior, generally speaking, to all the great natural transactions chronicled by geology.” Science does not contradict, it rather confirms, that voice of revelation or tradition, which assigns about six thousand years as the period of man's residence upon the earth. The action of the drama, then, is restricted within

moderate limits as to time, and the "natural agencies" and "higher principles" must work fast in order to accomplish their task within the prescribed period. One condition for the creation of a new and permanent species, belonging to any of the higher orders, seems to have escaped our author's notice ; at least two individuals, a male and a female, must have been evolved out of the next lower race, before the new species could continue its kind. Apply these considerations to the creation of man, who, according to our author's Scripture, was born of a monkey. To suppose, that, at the first trial, an Adam and an Eve were born near each other, so that they might have a chance of meeting in the course of their lives, would look too much like the operation of intelligence and design. On the theory of an organic creation by law, as the monkey race is spread over large regions of the globe, we must suppose that many of each sex were produced, and died childless, before any Adam was happy enough to find an Eve. Then, at no very distant period, within a few thousand years, the birth of a man from an animal of a lower type was no very strange event. Probably it occurred so often, that the monkeys themselves ceased to be astonished at it. And yet, this tribe of animals, with all the benefit of large experience, with increased numbers, and with all the requisite conditions fulfilled at least as perfectly as they were at the earlier period of their history, have not succeeded, in the three or four thousand years during which they have been subject to the observation of intelligent beings, in producing even a decent semblance of a man.

With the exposure of this crowning absurdity, we must close our direct examination of this "History of Creation." We have not room to consider some of the appendages to the theory, such as the assertion of the essential unity of the human and the brute intellect, the denial of the immaterial nature of mind, and the advocacy of the system of phrenology. These absurd and degrading doctrines are naturally connected with the atheistic hypothesis we have been considering. They are its legitimate children. But they have already been refuted so often and so conclusively, that any revival of them at the present day is hardly deserving of notice. If we should stop here, then, it may fairly be left to the judgment of our readers, whether we have not fulfilled the pledge given at the outset, by showing that this theory is

faulty at every point, even when viewed from the author's own ground. The proposal of it is no new thing. In one or another form, varying in particulars, but agreeing in substance, it has been before the world ever since the days of Democritus, and more especially of his follower, Epicurus. Lucretius clothed it in sonorous and majestic verse, for it is a theme fitted above all others to excite the fancy, and to receive the richest embellishments from the imagination. Modern authors have promulgated it again and again, with little other change than what was requisite to adapt it to recent improvements in science, and to engraft upon it some of their own favorite hypotheses and fancies. The version of it by the French naturalist Lamarck was the latest and the most in vogue, till the appearance of the present volume. So frequently has it been confuted, that the revival of it at this late period seems little more than a harmless exercise of ingenuity, a poetical and scientific dream, and one need hardly take the pains to expose its assumptions and fallacies. The violent suppositions which it involves only remind one of the remark quoted from Pascal on a former page, that "unbelievers are the most credulous persons in the world." If set forth only as a novel and pleasing fancy, it may be classed with other ingenious fictions, that are published without a thought of deception. But if seriously proposed, it can be fitly characterized only by borrowing the homely but energetic language of Dr. Bentley.

"And now that I have finished all the parts which I proposed to discourse of, I will conclude all with a short application to the atheists. And I would advise them, as a friend, to leave off this dabbling and smattering in philosophy, this shuffling and cutting with atoms. It never succeeded well with them, and they always come off with the loss. Their old master, Epicurus, seems to have had his brains so muddled and confounded with them, that he scarce ever kept in the right way; though the main maxim of his philosophy was to trust to his senses, and follow his nose. I will not take notice of his doting conceit, that the sun and moon are no bigger than they appear to the eye, a foot or half a yard over; and that the stars are no larger than so many glow-worms. But let us see how he manages his atoms, those almighty tools that do every thing of themselves, without the help of a workman. When the atoms, says he, *descend* in infinite space (very ingeniously spoken, to make high and low in infinity), they do not fall plumb down, but decline a little from the perpendicular,

either obliquely or in a curve ; and this declination, says he, from the direct line is the cause of our liberty of will. But, I say, this declination of atoms in their descent was itself either necessary or voluntary. If it was necessary, how then could that necessity ever beget liberty ? If it was voluntary, then atoms had that power of volition before ; and what becomes then of the Epicurean doctrine of the fortuitous productions of worlds ? The whole business is contradiction and ridiculous nonsense." — *Bentley's Works*, Vol. III., pp. 47, 48.

Custom and convenience lead us to speak of the "laws" of nature, and of the "powers and forces" of brute matter ; and few persons, in adopting these phrases, are aware that they are using a figure of speech. Yet nothing is more certain than that all the researches of science have not been able to point out with certainty a single active cause apart from the operation of mind. We discern nothing but regularity and similarity of sequences ; and the attribution of these effects to some occult qualities in the atoms or molecules in which they are manifested is wholly hypothetical, and even, when closely examined, is inconceivable. For this reason we affirm, that the theory of our author, professing to account for the whole work of creation "by the operation of law," is not only unsound and baseless in its particulars, but, when scrutinized as a whole, is absolutely unintelligible. *He attempts to account for a string of hypothetical effects, such as spontaneous generation and the transmutation of species, by a series of hypothetical and inconceivable causes, such as the energies of lifeless matter.* Let any one conceive, if he can, of any power, energy, or force inherent in a lump of matter, — a stone, for instance, — except this merely negative one, that it always and necessarily remains in its present state, whether this be of rest or motion. Let him point out, if he can, the *nexus* between what are usually denominated cause and effect in matter, — as when two bodies are drawn towards each other, if they are in opposite states of electricity. When he says that it is the *nature*, or *law*, of bodies thus electrified to attract each other, he offers no explanation of the phenomenon ; he only refers it to a class of other results, of a similar character, previously observed. It is not pretended, that all or any of these results, formerly known, are more intelligible or explicable than the one in question. But the latter is classed with them, because, from their

general similarity, from their taking place under the same outward circumstances, it is reasonably supposed that *one* cause, whatever it may be, is common to them all. And this is the whole business of the student of nature, to place together results which are so similar, that we may attribute them to a common cause, without assuming to know what that cause is. The sole office of science is the theory, not of causation, but of classification. It is all reducible to natural history, the essence of which consists in arrangement.

We are not attempting to perplex a plain matter of science by introducing into its discussion a metaphysical subtilty. The principle here contended for is one of the first dictates of the inductive philosophy, and as such it has been frankly acknowledged and acted upon by all the great improvers of science in modern days. When Newton discovered that the planets circle round the sun in the same manner in which a stone thrown by the hand describes a curve before reaching the earth, he may be said to have *explained* the former phenomenon by bringing it into the same class with certain results which have long been familiar to us. But the explanation was only relative, not absolute. The latter phenomenon is, in reality, no more explicable than the former; he did not pretend to know the *cause* of the stone's falling to the ground, any more than of the revolution of the planets. It was something to be able to arrange these apparently heterogeneous results in the same class, and gravity was a convenient name to apply to the whole. But the supposition, that gravity was an occult cause, inherent in matter, he earnestly repelled, and declared that it was "inconceivable." * Franklin showed, that a thunder-cloud and the charged conductor of an electrical machine manifested the same phenomena, and might therefore be classed together; sparks were obtained from both,

* "It is inconceivable, that inanimate brute matter should, without the mediation of something else, which is not material, operate upon and affect other matter without mutual contact, as it must, if gravitation, in the sense of Epicurus, be essential and inherent in it. And this is one reason why I desired you would not ascribe innate gravity to me. That gravity should be innate, inherent, and essential to matter, so that one body may act upon another at a distance through a *vacuum*, without the mediation of any thing else, by and through which their action and force may be conveyed from one to another, is to me so great an absurdity, that I believe no man, who has in philosophical matters a competent faculty of thinking, can ever fall into it. Gravity must be caused by an agent acting constantly according to certain laws." — *Newton's letter in Bentley's Works*, Vol. III., pp. 211, 212.

Leyden jars were charged from them, other bodies were attracted and repelled in a similar way, so that it was reasonable to believe that the same agency was acting in both cases. What this agency was he did not even guess. The *cause* of electric action, whether in the excited cloud, or the excited tube, was just as obscure as ever. Chemists observed, that different substances, when brought into close contact, sometimes remained distinct, and sometimes united with each other in various but regular proportions ; and these capacities of coalescing with one class of bodies, and of remaining unaffected by another, are called chemical "affinities." This is a convenient generalization, and has properly received a specific name ; though the common appellation throws no light on the *cause* of the phenomena, which remains an impenetrable secret. To say that certain action is *caused* by the operation of chemical affinities is only to arrange it with a large class of other observed appearances, equally obscure as to their origin and essential character.

Let us go a step further, and suppose that the progress of discovery has made known certain facts lying behind the phenomena in question, to which they may all be referred. Let us suppose, that all bodies which gravitate towards each other are found to be embosomed in a subtile, ambient fluid, which connects them, as it were, into one system ; that the positive and negative states of electricity are resolvable into the presence of two fluids standing in certain relations to each other ; and that substances show chemical affinity for each other only when they are in opposite electrical conditions. Still, we have only advanced a step in the generalization, and the real, efficient *cause* of the appearances is still hidden from us by an impenetrable veil. Gravitation is now referred to the communication of motion by impulse ; electricity, to the combination and separation of different fluids ; affinity, to the attraction or repulsion of these fluids. The latter classes of phenomena are more general, but not a whit more explicable, than the former. We have now fewer causes to seek for, but not one of these few has been discovered. When we have resolved electricity or gravitation into the presence of an elastic medium, it is a mere figure of speech to say, that we have discovered the *cause* of the electric phenomena or of gravity. That is just as far off as ever ; for we have yet to discover the principle whence flow *neces-*

sarily all the phenomena observable in fluids. It is the sole end and the highest ambition of science to discover as many as possible of the relationships which bind facts together, and thus to carry the generalization to the farthest point. Its office is not to discover causes, but to generalize effects. The investigation of real causes is quite given up, as a hopeless undertaking.

Observe, now, how all the phraseology employed in speaking of these successive generalizations of science is borrowed from the action of mind. The word *action* itself has no real significance, except when applied to the doings of an intelligent agent ; we cannot speak of the *doings* of matter, as we could if the word *action* were applicable to it in any other than a figurative sense. Again, in speaking of the similarity of facts and the regularity of sequences, we refer them to a *law* of nature, just as if they were sentient beings acting under the will of a sovereign. Parts of pure matter — the chemical elements, for instance — do not *act* at all ; being brute and inert, it is only by a strong metaphor that they are said to be subject to law. Again, we attribute *force*, *power*, &c., to the primitive particles of matter, and speak of their natural *agencies*. Just so, we talk of *tone* in coloring, and of a *heavy* or *light* sound ; though, of course, in their proper significance, tone belongs only to sound, and heaviness to gravitating bodies. These modes of speech are proper enough, if their figurative character be kept in view ; but it is a little too bad, when a whole scientific theory is made to rest upon a metaphor as its sole support. *Agency* is the employment of one intelligent being to act for another ; *force* and *power* are applicable only to will ; they are characteristic of volition. It is a violent trope to apply either of these words to senseless matter. Chemical *affinities* are spoken of, as if material elements were united by family ties, and manifested choice, and affection or aversion.

An obvious corollary from these remarks is, that all *causation* is an exertion of mind, and is only figuratively applied to matter. It necessarily implies power, will, and action. An efficient cause — we are not speaking now of a mere antecedent — is that which is necessarily followed by the effect, so that, if it were known, the effect might be predicted antecedently to all experience. Cicero describes it with philosophical accuracy. “ *Causa ea est, quæ id efficit, cujus est causa.* ”

Non sic causa intelligi debet, ut quod cuique antecedit, id ei causa sit; sed quod cuique EFFICIENTER antecedit. Causis enim efficientibus quamque rem cognitis, posse denique sciri quid futurum esset." Now, in the world of matter, we discover nothing but antecedents and consequents; the former are the mere signs, not the causes, of the latter; no necessary connection — no connection at all, except sequence in time — can be discerned between them. Consequently, from an examination of the former, we could not determine *a priori*, that they must be followed by the latter, or by any other result whatever. Our knowledge here, if knowledge it can be called, is wholly empirical, or founded on experience. As we have seen, it is absurd to say, that one atom of matter literally *acts* on another. On the other hand, in the world of mind, we are directly conscious of action, and even of causation. All mental exertion is true action; every determination of the will implies *effort*, or the direction and use of power. The result to be accomplished is preconsidered, or meditated, and therefore is known *a priori*, or before experience; the volition succeeds, which is a true effort, or a power in action; and this, *if the power be sufficient*, is necessarily followed by the effect. Volition is a true cause; but in a finite mind it is not always an *adequate* cause. If I will to shut my eyes, the effect immediately follows as a necessary consequence. But if I will to stop the beating of my heart, or to move a paralyzed limb, the effect does not follow, because the power exerted is inadequate to the end proposed. The action of the will is still *causative*, but it is *insufficient*.

It was from overlooking the distinction here made, that Hume, Kant, and other metaphysicians were led to deny all knowledge of causation even in the action of mind. They confounded sufficiency with efficiency, and supposed, because the power did not always accomplish the end proposed, that it did not tend towards it, or exert any effect upon it. As the sufficiency of the volition can only be known *a posteriori*, or after experience, they imagined that there could be no cause but that which is infinite, or one which is invariably followed by the whole effect contemplated. They overlooked the fact, that, in the consciousness of *effort*, — as in the attempt to control the action of mind, to command the attention, &c., — we have direct and full evidence of *power*

in action, which is necessarily causal in its nature. The mental *nisus* is true force, exerted with a foreknowledge of the effect to be produced, and necessarily followed by a result, — a partial one it may be, — but one which is a true effect, whether it answers the whole intention, or not. Here, then, we discern that necessary connection between two events, that absolute efficient agency, which was vainly sought in the world of matter.

If these considerations are well founded, the whole framework of what are called “secondary causes” falls to pieces. The laws of nature are only a figure of speech; the powers and active inherent properties of material atoms are mere fictions. Mind alone is active; matter is wholly passive and inert. There is no such thing as what we usually call the course of nature; it is nothing but the will of God producing certain effects in a constant and uniform manner; which mode of action, however, being perfectly arbitrary, is as easy to be altered at any time as to be preserved. All events, all changes, in the external world, from the least even unto the greatest, are attributable to his will and power, which, being infinite, is always and necessarily adequate to the end proposed. The laws of motion, gravitation, affinity, and the like, are only expressions of the regularity and continuity of one infinite cause. The order of nature is the effect of divine wisdom, its stability is the result of divine beneficence.

“*Estne Dei sedes nisi terra, et pontus, et aer,
Et cælum, et virtus? Superos quid querimus ultra?
Jupiter est quodcunque vides, quocunque moveris.*”

It may be asked, if divine power, instead of operating immediately throughout the universe, might not have endowed material atoms at the outset with certain properties and energies, the gradual evolution of which in after ages would produce all the phenomena of nature, without the necessity of his incessant presence, agency, and control. Certainly, we may not put bounds to omnipotence; though we may assert of a given hypothesis respecting its exercise, that it is inconceivable, or involves wholly incongruous ideas. The necessary attributes of matter, according to our conception of it, are extension, figure, impenetrability, and inertness; the properties of mind are thought, sensation, activity, and will. These attributes are essential, not arbitrary or contingent; for they make up our whole idea of the substances in which

they inhere. We can no more suppose them to be interchangeable, than we can literally attribute dimensions to an odor, or capacity to a sound. To speak of an extended thought, an impenetrable sensation, an inert activity, is to talk nonsense; it is equally absurd to attribute thought to extension, sensation to figure, activity to inertness,* or causal agency to matter. True, mind may be superadded to matter, without being confounded with it, and without any exchange of properties. And in fact, this is the only conceivable form of the hypothesis now before us; namely, the theory of the ancient metaphysicians, that every particle of matter and every aggregate of it is accompanied, or animated, by a distinct mind. "*Ea quoque [sidera] rectissime et animantia esse, et sentire atque intelligere, dicantur.*" If this be a more intelligible and plausible supposition than that of one infinite mind, pervading the universe, and producing all physical changes by its irresistible power, the materialist is welcome to the benefit of it.

As respects the manner in which all physical effects are produced by the direct action of the Deity, we are not bound to offer any explanation, as the subject confessedly transcends the limit of the human faculties. It is enough for us, that the supposition is the only conceivable one, the only mode of accounting for the phenomena of the material world. But as man is made in the image of his Creator, in the union for a time of his spirit with his corporeal frame we may find at least an intelligible illustration of the connection of God with the universe. Discarding the word *mind*, as the fruitful source of vague speculation and error, let us look for a moment at that of which it is a mere synonyme, — at the man himself. The sentient, thinking being, which I call *self*, is an absolute unit. Duality or complexity cannot be predicated of it in any intelligible sense. Personality is indivisible; *I* am *one*. This being is capable of acting in different ways; and for convenience of speech and classification, these modes

* And yet, so strong is the propensity to metaphor, that scientific men talk of the *vis inertiae* as a true force, though the ideas expressed by the two Latin words are certainly incongruous. The mistake here arises from confounding inertness, or resistance to force, — a merely negative idea, — with the true force which is necessary to overcome it; or rather, since force can only be measured by its results, and must always be adequate to the effect produced, inquirers have adopted the convenient hypothesis of two antagonistic forces, not always recollecting that one of them is merely passive.

of action have been arranged as the results of different faculties ; though, in truth, it is no more proper to attribute to the person distinct powers and organs for comparison, memory, and judgment, than to give to the body separately a walking faculty, a lifting faculty, a jumping faculty, and so on. In the one case, these faculties are but different aspects of mental power ; in the other, but different applications of muscular strength. Of course, the complex material frame, with its numberless adaptations and arrangements, in which this being is lodged, is truly foreign from the man himself, having a kind of connection with him, in reality, but one degree more intimate than that of his clothes. The body is the curiously contrived machine through which the man communicates with the material world. The eye is but his instrument to see with, the ear is his trumpet for communicating sound to him, the leg is his steed, and the arm his soldier. Many of these instruments and parts may be removed, or become unfit for use, without impairing, in the slightest degree, his distinct personality and intelligence. The particles of all of them are in a state of constant flux and renovation, so that man changes his body only a little more frequently than he does his coat. His whole corporeal frame is connected with him but for a while, and is then thrown aside, like an old garment, for which he has no farther use.

But during the period of its existence, how close and intimate in appearance is this union with the body ! Sensation extends to every part of it, every fibre is instinct with life, and the direction of the will is absolute and immediate over every muscle and joint, as if the whole fabric and its tenant were one homogeneous system. The will tires not of its supremacy, and is not wearied with the number of volitions required of it to keep every joint in action, and every organ performing its proper function. It would not delegate the control of the fingers to an inferior power, nor contrive mechanical or automatic means for moving the extremities. Within its sphere, it is sole sovereign, and is not perplexed with the variety and constant succession of its duties, extending to every part of the complex structure of which it is the animating and directing spirit. Sensation is not cumbered with the multitude of impressions it receives, nor is the fineness of perception dulled by repeated exercise. The sharpness of its edge rather improves by use, and we become

more heedful of its lightest intimations. Is it irreverent, then, to suppose that this union of body and soul shadows forth the connection between the material universe and the Infinite One? How else, indeed, can we attach any meaning to the attributes of omnipresence and omnipotence? The unity of action, the regularity of antecedence and consequence in outward events, which we commonly designate by the lame metaphor of *law*, then become the fitting expression of the consistent doings of an all-wise Being, in whom there is no variableness, neither shadow of turning. The Creator, then, is no longer banished from his creation, nor is the latter an orphan, or a deserted child. It is not a great machine, that was wound up at the beginning, and has continued to run on ever since, without aid or direction from its artificer. As well might we conceive of the body of a man moving about, and performing all its appropriate functions, without the principle of life, or the indwelling of an immortal soul. The universe is not lifeless or soulless. It is informed by God's spirit, pervaded by his power, moved by his wisdom, directed by his beneficence, controlled by his justice.

"Spiritus intus alit, totamque infusa per artus
Mens agitat molem, et magno se corpore miscet."

The harmony of physical and moral laws is not a mere fancy, nor a forced analogy; they are both expressions of the same will, manifestations of the same spirit.

The objection, that it is beneath the dignity of the Almighty — *αὐτοῦ γε ἄνακτα* — to put his hand to every thing — is founded on a false analogy, as is seen by the form in which Aristotle states it. "If it befit not the state and majesty of Xerxes, the great king of Persia, that he should stoop to do all the meanest offices himself, much less can this be thought suitable for God." The two cases do not correspond in the very feature essential to the argument. An earthly potentate, unable to execute with his own hand all the affairs of which he has control, is obliged to delegate the larger portion of them to his servants; selecting the lightest part for himself, he gratifies his pride by calling it also the noblest, though the distinction is factitious, there being no real difference, in point of honor or dignity, between them. Omnipotence needs no minister, and is not exhausted or wearied by the cares of a universe. Power in action is more truly sublime than power in repose; and surely it is not derogatory to di-

vine energy to sustain and continue that which it was certainly not beneath divine wisdom to create and appoint. Rightly considered, to guide the falling of a leaf from a tree is an office as worthy of omnipotence, as the creation of a world. "Are not two sparrows sold for a farthing? and one of them shall not fall on the ground without your Father. But the very hairs of your head are all numbered."

Equally lame is the oft-repeated comparison of the universe to a machine of man's device, which is considered the more perfect the less mending or interposition it requires. A machine is a labor-saving contrivance, fitted to supply the weakness and deficiencies of him who uses it. Where the want does not exist, it is absurd to suppose the creation of the remedy. Human conceptions of the Deity are for ever at fault in imputing to him the errors and deficiencies which belong to our own limited faculties and dependent condition. Hence the idea of the Epicureans, that sublime indifference and unbroken repose are the only states of being worthy of the gods. Viewed in the light of true philosophy, no less than of Christianity, how base and grovelling does this conception appear! The sublime description of the pagan poet becomes the fitting expression and defence of the very theory it was designed to controvert:—

"Nam (proh sancta Deum tranquillâ pectora pace,
Quæ placidum degunt ævum, vitamque serenam!)
Quis regere immensi summam, quis habere profundi
Indu manu validas potis est moderanter habenas?
Quis pariter cœlos omneis convertere? et omneis
Ignibus ætheriis terras suffire feraceis?
Omnibus inque locis esse omni tempore presto?
Nubibus ut tenebras faciat, cœlique serena
Concutiat sonitu? tum fulmina mittat, et ædeis
Sæpe suas disturbet?"

Returning to the theory of our author, may we not now characterize it as at once unfounded in its details, inconceivable in its operation, and vulgar and mechanical in its design? Considered in their proper aspect, and by the light of a sound philosophy, whatever well accredited facts or legitimate deductions he has gleaned from the whole field of modern science afford the most striking evidence and illustration of that view of creation which is directly at variance with his own hypothesis. He has, in fact, exposed the insufficiency of what are called organic or mechanical laws to supply the losses, and bridge over the interruptions, that have occurred

in the world's history. Geology has rendered at least one signal service to the cause of natural religion, by effectually doing away with the old atheistic objection, that, for aught we know, the present constitution of things never had a beginning, but has gone on for ever renewing itself in an endless series of generations. Science now tells us distinctly, that time was when "the earth was without form and void," no animated thing appearing "upon the face of the deep"; that afterwards, "the waters were gathered together unto one place, and the dry land appeared." Then "the earth brought forth grass, and herb yielding seed *after his kind*, and the tree yielding fruit, whose seed was in itself, after his kind." Next was fulfilled the command, "Let the waters bring forth abundantly the moving creature that hath life, and fowl that may fly above the earth in the open firmament of heaven." Then appeared "the beast of the earth after his kind, and cattle after their kind, and every thing that creepeth upon the earth after his kind." Last of all, "God created man in his own image, male and female created he them." We are not merely quoting Scripture; we are repeating the facts positively affirmed by the geologists, and incorporated by our author into his "history" — as authentic leaves taken from the "stone book" — *in the same order* in which they are narrated in the first chapter of Genesis. The coincidence in the order of succession is certainly remarkable.

Geology farther informs us, that, at different times, all the animated tribes which had peopled the earth's surface passed away, or became extinct, and were replaced by new species of different organization and characteristics; and probably at many other periods, as well as on occasions of some great catastrophe in the earth's crust, races wholly unlike any that had preceded them were introduced, from time to time, as new inhabitants of the globe. Here, then, was an absolute necessity for the continuous operation of an intelligent creative power, apart from the blind mechanical laws, which, at the utmost, could only allow each species, once introduced, to continue its kind. The marvellous adaptations of these new races to the altered conditions of the earth's surface when they appeared, then, become additional proofs of the wisdom and constant oversight of a designing Creator. They came not till all things were ready; they appeared when the extinction

of former tribes had left a gap for them in the scale of being. The gradual development of what are called the powers of nature, — or, to speak more intelligibly, the successive improvements in the habitations intended for higher and higher races of animated life, — and the similarity of plan on which these races were organized, the scheme being preserved in all its essential features through countless generations, show unity of design, and prove that the works of creation, however separated in time, must be attributed to *one* intelligent author. The same conclusion follows almost irresistibly from the gradations at present observable both in the animal and vegetable kingdoms, so that all the races may be arranged, not indeed in a linear series, but in families or groups, bearing analogous relations to each other, and showing a general progress from the more simple to the more complex forms. Surely, these facts, so clearly explained by our author, instead of sustaining the corpuscular philosophy, directly militate with it, and afford the most satisfactory proof of the doctrine of the theist, and the theory of continuous divine agency. We have hardly ever met with a book that furnished more complete materials for its own refutation.

After all, the question is a very simple one. We have only to decide whether it is more likely, that the complex system of things in the midst of which we live, — the beautiful harmonies between the organic and inorganic world, the nice arrangements and curious adaptations that obtain in each, the simplicity and uniformity of the general plan to which the vast multitude of details may be reduced, — was built up, and is now sustained, by one all-wise and all-powerful Being, or by particles of brute matter, acting of themselves, without direction, interference, or control. We cannot now say, that possibly the system never had a beginning, but has always existed under the form in which it now appears to us ; geology has disproved *that* supposition most effectually. Choose ye, then, between mind and matter, between an intelligent being and a stone, for the parentage and support of this wonderful system. For our own part, we will adopt the conclusion of one of the most eloquent of those old pagan philosophers, on whose eyes the light of immediate revelation never dawned : — “*Hic ego non mirer esse quemquam, qui sibi persuadeat, corpora quædam solida atque individua vi et gravitate ferri, mundumque effici ornatissimum et pul-*

cherrimum ex eorum corporum concursione fortuità ? Quòd si mundum efficere potest concursus atomorum, cur porticum, cur templum, cur domum, cur urbem non potest, quæ sunt minus operosa, et multò quidem facilia ? Certè ita temerè de mundo effutiunt, ut mihi quidem nunquam hunc admirabilem cæli ornatum, qui locus est proximus, suspexisse videantur."

Gray, Fred.

1859, Sept. 19, Gift of
Capt. Charles H. Davis, U.S.A.,
of Cambridge.

1846.]

Explanations of the Vestiges.

465

ART. VIII. — *Explanations : — a Sequel to the Vestiges of the Natural History of Creation.* By the Author of that Work. New York : Wiley & Putnam. 1846. 12mo. pp. 142.

THE author of *Vestiges of the Natural History of Creation*, having, in successive editions, explained and more or less modified particular statements, has at length thought proper to publish this little volume, for the purpose of obviating alleged misapprehensions, and of reinforcing the general argument, — of “endeavouring to make good what is deficient, and reasserting and confirming whatever has been unjustly challenged,” in his book. We have read this new volume with attention, and are prepared to offer some remarks upon it.

We must in justice say, that our author preserves an invincible good-temper, equal to his implicit faith. He writes more clearly and soberly than he reasons. Seldom have such extravagant theories been set forth in language so calm and considerate. Seldom has a very winning style been made to cover such a multitude of logical sins. We feel sure that he is thoroughly convinced of the cogency of all his arguments, even where his reasonings are so loose, the special pleading so transparent, and the hypothesis defended so grossly improbable, that we might suspect any other writer of a course of bold experiments upon the credulity of his readers. The author has also made some palpable hits against his various reviewers. His original survey embraced almost all the physical and metaphysical sciences, with none of which does he seem to have more than a general acquaintance ; and he thus exposed himself on all sides to hostile attack, with a fearlessness which nothing but an extraordinary confidence in the strength of his position can explain. Some of his reviewers appear to have committed similar faults. Not content with merely repelling the enemy from the ground which they were, from their special knowledge, so well able to defend, they have sometimes, in the eager onslaught, carried the war too far *into* the enemy's country and *from* their own ; affording our author opportunities which he is quick and skilful in turning to advantage. Yet, however he may thus have rebutted particular

criticisms, he is far from having strengthened his general argument.

To avoid, as far as may be, a similar error, we propose to restrict our observations mainly to a single class of topics. We pass over "the nebular hypothesis," not, however, that we at all agree with the writer, who now thinks it unessential as the basis of his entire system of nature, but because it has no necessary connection with the points which we propose to examine. We admit that its overthrow would not refute his theory respecting the origin and development of living things; neither would its establishment lend to the latter any real support. Even if the earth were proved to be made of the most attenuated star-dust, it would be none the more probable that man is "an advanced type" of the monkey race. The two are essential parts of our author's general and thoroughly consistent scheme; but the "nebular theory" and the "transmutation theory" require to be independently established. Although the former must ever remain a gratuitous hypothesis, against which the current of recent astronomical observation is setting strongly, to the manifest annihilation of whatever probability it may once have had, still it may be less open to direct objection than the rest of the book. Nor do we think it so "remarkably illustrated" by the experiments of Professor Plateau, which leave all the real difficulties just where they were before. To show that the world might have been thus made, he still needs an extrinsic agent, the stick or disk with which to stir the nebulous chaos about, and *the hand to move it*.

But granting that the world is made, we are now concerned only with his plan for peopling it. A formal restatement of his whole theory on the subject is scarcely necessary. Our readers are doubtless familiar with it from the perusal of his original work, and of our former article upon it. We cull a few sentences from the new volume, that we may be sure to exhibit his latest and matured views.

"LIFE is everywhere ONE. The inferior animals are only less advanced types of that form of being perfected in ourselves."—pp. 130, 131.

Does our author merely mean to say, in common with all modern physiologists, that the various races of animals are formed according to one type or model, of which the hu-

man body may be taken as the highest expression? Is it the ordinary philosophical doctrine of a unity of plan traceable throughout the organic creation, that is here propounded? Or, is it meant that there is no essential difference, except in *the degree of development*, between a reptile, a monkey, and a man? The following sentences give an unambiguous and explicit answer to these questions.

"I suggest, that a line of organization, analogous to the progress of the embryo of an elevated species, had passed in the course of time through its appointed stages of development, each of which is a small advance upon the preceding, and the type of a form thenceforth to continue permanent." — pp. 67, 68.

The different species of animals are "transmutations," to use his own word, of earlier and simpler species. The land animals, as we shall presently see, are the transmuted progeny of the humbler denizens of the ocean. Are we, then, to infer that the great Author of being has specifically created each higher race of animals out of the next lower? By no means; the idea of specific creation in any form is quite inconceivable to the writer's mind. In his view, every thing points to "some simply natural procedure in the origin of the present tribes." "The probable fact is, that the modification takes place in an offshoot of the original tribe, which *has removed to a different set of circumstances, these circumstances being the cause of the change.*" In reply to a reviewer who says, "They were created by the hand of God and adapted to the conditions of the period," our author strongly affirms:—

"If he here means a special exertion of the powers of the Deity, having a regard to special conditions, we part company, for my object is to show that animals were indebted for their gradations of advance *to a law generally impressed by the Deity upon matter, and that their external peculiarities are owing immediately to the agency of those very conditions* to which they are supposed [according to the common view] to have been adapted." — pp. 94, 95.

And the writer goes on to "contend that there was no more need for a special exertion to produce, for instance, mammalia, than there is for one to carry" on the growth of an individual animal of the class from the embryo and infantile to the adult state. By this we understand, not that the

divine power is as requisite to uphold and preserve as to create, but that there is no essential difference in the two cases, — that one sort of animal arises out of another sort, under favoring circumstances, by a process quite as natural as that, and strictly comparable to that, by which the same animal grows, comes to maturity, and bears offspring. And here, as the proper *pendant* to this “development,” we must cite a statement, perhaps the only one in the book to which we cordially and fully subscribe.

“So long as this [the origin of the organic kingdoms] remains obscure, the supernatural will have a certain hold upon enlightened persons. Should it ever be cleared up in a way that leaves no doubt of a natural origin of plants and animals, *there must be a complete revolution in the view which is generally taken of our relation to the Father of our being.*” — p. 105.

Yes, the revolution would indeed be complete, and, for aught that we can see, would take us back again to the days of Democritus and Epicurus. This “prolonged gestation of nature” gives birth to conclusions as incongruous with any common theistic scheme as they are revolting alike to our religious and our common sense. But we are now concerned only with its scientific bearings. We must receive it, if proven, and build up our religious belief by its side as well as we may. If, on the other hand, it remain simply unproven, will it not be rejected with hearty disgust? To our minds, it appears as contrary to all just analogy as it is devoid of proof. We are bound, however, to contemplate our author’s very ingenious method of setting forth the antecedent probability of his theory. That this may be done fully and fairly, we make an ample quotation, which may also serve as a specimen of the author’s usual mode of reasoning. After developing and defending the nebular hypothesis, he proceeds : —

“We have fixed mechanical laws at one end of the system of nature. If we turn to the mind and morals of man, we find that we have equally fixed laws at the other. The human being, a mystery considered as an individual, becomes a simple natural phenomenon when taken in the mass, for a regularity is observed in every peculiarity of our constitution and every form of thought and deed of which we are capable, when we only extend our view over a sufficiently wide range. It is to M. Quetelet, of Brussels, that we are indebted for the first satisfactory explication

of this great truth: it is presented in his well known and very able treatise, *Sur L'Homme, et le Développement de ses Facultés*. He first shows the regularity which presides over the births and deaths of a community, liable to be affected in some degree by accidental circumstances, but fixed again when these are uniform. He then makes it clear, that the stature, weight, strength, and other physical peculiarities of men are likewise regulated by fixed principles of nature. Afterwards, the moral qualities, — the impulses of all our various sentiments and passions, — even the tendency to yield to those temptations which give birth to crime, — are proved to be of no less determinate character, however impossible it may be to predict the conduct of any single person. These are doctrines not to be resisted by inconsiderate prejudices. They rest on the most powerful of all evidence, that of numbers. What we are at present concerned with is the simple fact, that Morals — that part of the system of things which seemed least under natural regulation or law — is as thoroughly ascertained to be wholly so, as the arrangements of the heavenly bodies.

“ Now we have here two most remarkable truths. The wondrous masses which people the Mighty Void are under the control of natural law. The workings of the little world of the human mind — the opposite extreme of the system — are under law likewise. We have thus the character of the *limits* of the system fixed. So far we proceed upon solid ground. Now it has been seen that phenomena precisely the same as the formation and arrangement of worlds take place daily before our eyes, under the influence of the laws of matter, showing that the whole cosmogony might have been affected — proving, indeed, that it *was* affected — by the Divine will acting in that manner. Having attained this point, we are called upon to remember the many appearances of unity in nature; how, when we take a sufficiently wide view, there is nothing discrepant and exceptive in it; how a noble and affecting simplicity breathes from it in every part. So reflecting, we ask, ‘ Can it be that, as the first and the last parts of the system are under law, and the first (this being also the greatest) was manifestly created in that manner, so the whole is under law, and has been produced in that manner?’ It is at the moment when we have arrived at this question, that the origin of the organic world becomes a point of importance. The skeptic of science steps in, and says, ‘ No; the idea of an entire system under law, and produced by it, here breaks down; for who can pretend to penetrate the mysteries of vitality and organization? and who can say that species have had other than a miraculous origin?’ The tone in which this objection is usually made seems to me inappropriate, considering that the objectors stand on a

mere fragment of nature, and one which the discoveries of science are every day lessening. It is but in a nook, to which light has not yet penetrated, that the opponents of the theory of universal order take refuge. On coming to the consideration of the question, I am at the very first struck by the great *a priori* unlikelihood that there can have been two modes of Divine working in the history of nature, — namely, a system of fixed order or law in the formation of globes, and a system in any degree different in the peopling of these globes with plants and animals. Laws govern both : we are left no room to doubt that laws were the immediate means of making the first ; is it to be readily admitted that laws did not preside at the creation of the second also, particularly when we find that laws equally at this moment govern and sustain both ? Most undoubtedly, it would require very powerful evidence to justify such an admission. And, on the other hand, it would require very decisive counter-evidence to forbid the conclusion, that the organic creation originated in law." — pp. 17–20.

As the author has apparently deceived himself in these pages, he may have succeeded in mystifying many of his readers. That the whole creation was made "under law," that is, according to a preordained harmonious plan, emanating from a supreme intelligent will, which we cannot conceive of but as working according to a plan, it needs no such parade of statement as this to demonstrate. But how this lends any confirmation to the transmutation theory we cannot conjecture. The unity which we perceive in nature, — the striking adaptation of one part to another, and of each to the great whole, the mingling of beauty with usefulness, — to these sound science has ever delighted to point, as the proof that all is the direct handiwork of a single omniscient Creator. But it is quite another thing to maintain that "the laws which govern and sustain," or, as we should say, *according to which* things are governed and sustained, "were the immediate means of making" the things themselves. The movements of the planets in their orbits, sun, moon, and stars fulfilling regularly their appointed courses, show that they are under law, — that they not only *had* a Creator, but *have* a Governor. So, likewise, the regular development of the animal or vegetable frame from the embryo to the mature state, the regular performance of the offices and functions which we clearly perceive it was specially designed to perform, and the unvaried production by each species of an off-

spring like itself, — the oak producing oaks, and never pines, animalcules giving rise to animalcules, and not to fish or quadrupeds, monkeys giving birth to monkeys, and not (as the writer maintains) to men, — this general fact, confirmed by the most extended observation, that each species remains true to its character, — all show, to be sure, that the organic creation is under law in the same sense that the heavenly bodies are, but all speak of a very different law from that of transmutation. If any thing has been settled by human observation, it would seem to be this, — the actual uniform production by each species of seed specifically after its kind. “Do men gather grapes of thorns, or figs of thistles?” The antecedent probability, therefore, lies directly the other way. Arguing from the *well known* towards the *obscure*, which is the only sound and safe proceeding, may we not infer that the species which are now fixed and stable have been so ever since their creation?

Again, it is here implied and elsewhere asserted, — indeed, it is the very gist of the whole doctrine, — that the laws which we see in operation will account for the origin and actual state of the things themselves in connection with which the laws operate. That is to say, not only do the planets move according to the law of gravitation, but the law of gravitation gave birth to the planets; and the laws of organization, &c., not only operate in plants and animals, but are to account for the original creation of the plants and animals themselves. But do just analogies, does the current of evidence, lead towards any such conclusions? Are we to suppose that the force which keeps a watch going, and the arrangements by which it measures time correctly, are in any respect identical with the efficient cause that made the watch? Can we say that its “external peculiarities are owing to the agency of those very conditions to which they are [commonly] supposed to have been adapted”? The laws which we study and admire, whether in the inorganic or organic world, explain the succession of phenomena, but throw no light upon the origin of the bodies in which the phenomena are observed. They show us how things go on; they do not tell us how they began. The phenomena of life, however profoundly studied, have afforded no clew to the origin of life, or to the origin of the species through which the life is manifested. We have learned many of the conditions of

life; we have knowledge which enables us to exclude negatively many an hypothesis, that of our author among the rest. Recognizing certain laws in the succession of the phenomena, and the uniformity of the result, we safely conclude, till the contrary be proved, not only that such will continue to be the course of things, but that it has been so from the first. And since the laws which explain the growth and propagation of the species fail to account for their origin, we properly refer the latter to a different, anterior cause. It is not our business to maintain, that the Deity does not work through what are called secondary causes, even in the act of creation. We only deny that there is any proof of it, or that just analogy favors it. We only affirm, that, up to this time, science has furnished no clew to the mode of the divine operation in the origination of a species of plant or animal. Abler pens than ours have shown, that the agencies now in operation will not account for the origin of any created thing. Our author has his case to make out against all antecedent probability.

If it were quite fair to turn a man's false reasonings against himself, we might say that the writer furnishes us, in the pages above quoted, with a pertinent illustration to show that the law of the succession of the phenomena may stand totally irrelevant to any notion of causation. Have the so-called laws of statistics, which he turns to such account, and which, he says, prove that birth, and death, and crime are as thoroughly under the control of fixed law as the arrangements of the heavenly bodies, any thing to do with the *causes* of birth, or death, or crime? Is a child now born to A. B., because it is ordained by statistical law, that, on the general average, there shall be so many births in the Commonwealth each year? Does C. D. steal, E. F. forge, or G. H. convey the funds of his creditors to Texas or Oregon, on the same principle? Does J. K. yield to sudden temptation, that the law of Professor Quetelet may be fulfilled? But our chief object in adverting to the statement is to show how readily our author imposes on himself, and, under the name of *law*, confounds things as different in nature as his own so-called "fixed laws of morals," the moral law, the common law, and the law for the annexation of Texas. If he really supposes that the natural-development theory is in any wise strengthened by bringing it into the field flanked by the

nebular hypothesis on one side, and the laws of statistics on the other, we merely suggest that the case would be stronger, if the first were capable of proof or sustained by probability, if the latter were laws at all, any more than what are called the laws of chance, and, finally, if there were any real connection between the three. The analogical argument here rests on a baseless vision and a fallacy.

Before considering the question on its own merits, let us notice some other specimens of our author's favorite mode of argumentation, which, we find, passes for "demonstration strong" in some quarters.

"The great fact established by it [geology] is, that the organic creation, as we now see it, was not placed upon the earth at once;—it observed a PROGRESS. Now we can *imagine* the Deity calling a young plant or animal into existence instantaneously; but we see that he does not usually do so."—pp. 21, 22.

That the different sorts of plants and animals were not *all* placed upon the earth at once, we willingly admit. No doubt, they were created at different periods. But the notion, that the Deity does not create a young plant or animal *instantaneously*, is quite new to us. Is, then, the animal in question for a while in a sort of limbo somewhere between the *esse* and the *non esse*,—a *tertium quid*, neither create nor uncreate,—like the statue of Pygmalion not yet quite transformed from ivory to flesh and blood, or like as when

"Now half appeared
The tawny lion, pawing to get free
His hinder parts,"

in Milton's glorious cosmogony? A far more sensible scheme of organic creation, by the way, than that of the Vestiges; for the

"Innumerable living creatures, perfect forms,
Limbed and full grown,"

the lions, leopards, and cattle, all come in character from the first, "each in their kind," and do not make a progress through the shapes of animalcules, fish, reptiles, and other vile spawn,—a sort of Hindoo transmigration run mad. Being gifted with a lively fancy, the writer can, it seems, imagine the Deity calling a young plant or animal into existence "instantaneously." Let him try for a moment to imagine the

contrary. If successful, he can then hopefully attempt something further ; and, since putting out of existence may doubtless be managed in the same gradual way, the case of a man "killed a little" will appear quite natural to him. But the remainder of the paragraph may throw further light on the author's meaning.

"The young plant and also the young animal go through a series of conditions, advancing them from a mere germ to the fully developed repetition of the respective parental forms. So, also, we can *imagine* Divine power evoking a whole creation into being by one word ; but we find that such had not been his mode of working in that instance, for geology fully proves that organic creation passed through a series of stages before the highest vegetable and animal forms appeared. Here we have the first hint of organic creation having arisen in the manner of natural order." — p. 22.

Few persons, we presume, would confound two things so different in nature, as the creation of a living being *ab origine*, and the growth of an offspring from the germinal to the adult state. It is true that the writer's theory confounds the two, and teaches that the higher animals, and man himself, have been born from the animalcule and the worm, as the result of a "prolonged gestation." But this is the very point to be proved, and must not be assumed at the outset. We, also, when in an imaginative mood, "can imagine divine power evoking a whole creation into being by one word" ; and in fact, now we think of it, the first cosmogony we ever read proceeded very much upon this principle. And, although "geology fully proves" that there have been various creations, that different species were created at different periods, and that some of the humblest and simplest first appeared, while land animals, quadrupeds, quadrumana, and bimana were not introduced until after the earth was fitted for their residence, yet we are still to be convinced that they were not *then* created as perfect as they now are. This is the very matter in dispute.

Take the subjoined extract as another specimen of a *priori* reasoning. In the earlier Silurian period,

"There were seas supporting crustacean and molluscan life, but utterly devoid of a class of tenants who seem able to live in every example of that element which supports meaner creatures.

This single fact, that only invertebrated animals now lived, is surely, in itself, a *strong proof* that, in the course of nature, *time* was necessary for the creation of the superior creatures. And, if so, it undoubtedly is a powerful evidence of such a theory of development as that which I have presented. If not so, let me hear any equally plausible reason for the great and amazing fact, that seas were for numberless ages destitute of fish." — p. 31.

'To us, the most "amazing fact" is the confidence of appeal to the absence of the fossil remains of fish from the Lower Silurian rocks as "strong proof" that the Almighty had not yet had time enough to create them. The book is full of this kind of reasoning. The author's vision has become so hopelessly blar, from continually looking at every thing through the spectral medium of his own hypothesis, that he no longer beholds objects in their natural form or colors. But a sober and reverent person (if he felt bound to render a reason at all why the Deity did *not* do this or that) would prefer to say that the proper time for creating "the superior beings" had not yet arrived. Pen, ink, and paper lie in readiness before us, but no writing yet appears. Does this render it probable that time is necessary for the evolution of the characters through some natural law? Might it not be a sounder inference, that, for reasons of our own, we are not yet quite ready to write? The author's conclusions, however, are in strict and necessary accordance with his hypothesis. When his readers wonder that the idea of a *supreme will, acting through time*, seems never to occur to him, they should not forget that this view is necessarily excluded by the very terms of his theory. So much the worse for the theory.

If it were worth while, it would be easy to gather the elements of a sufficient answer *ad hominem* to this confident argument. Here are rocks, formed by marine deposit, in which no remains of fish have yet been found. Our author positively concludes that fish were not yet created. And a few pages back he emphatically declares, in these, his own Italics, "*A time in which there was no life* is first seen. We then *see life begin, and go on.*" But on turning over a leaf or two, we find him smiting an unwary geological critic with a weapon which the wielder should remember is two-edged, and may cut backward as well as forward.

"Does the lowest band of the English Lower Silurians indicate, beyond all question, the point of time at which animal life

commenced upon our planet? Are we quite sure that cephalopoda were among the first of all earth's living creatures? Far from it. It has only been ascertained that certain comparatively small cephalopods are found as far down as any other animals of inferior organization, at certain spots in Wales and Cumberland. When we remember, that, in modern seas, certain kinds of such animals haunt special places suitable for their subsistence, — that we may have crustacea and mollusks exclusively at one place, and radiata (as corals and zoöphytes) at some other, not perhaps far distant, but different with respect to depth or some other circumstance, — we can conceive that cephalopods may occur in the first fossil bands in the places which have been examined in England, and yet remains of inferior animals may be found by themselves on the same or a lower level in some as yet unexplored place not far off; so that a time-interval may there appear to allow for a progressive development. Such seems but a reasonably cautious surmise, when we are told by a high authority, that there are 'detached Silurian districts in England, presenting particular changes and modifications, arising from difference of depth, and the variety of currents, and chemical combinations in the seas in which they were formed;' and that, 'in consequence of this variety of physical condition, *there is a corresponding diversity in the traces of organic life in each situation.*' The chemical experiments of Braconnot upon masses of these earlier rocks gave ammoniacal and combustible products, likewise indicative of the presence of organic matter: in the same sub-silurian region, 'fragments, apparently organic, and resembling cases of infusoria,' have been detected, and in Bohemia actual fossils have been announced. Even dubious traces of life in sub-silurian rocks must be admitted to be of importance, when we consider that they have mostly been subjected to such a degree of heat as could not fail to obliterate organic memorials, seeing that it has even changed the texture of the rocks themselves. From what Mr. Lyell saw of the Silurian rocks in America, he finds himself called upon, in the most emphatic manner, to warn geologists against '*the hasty assumption, that in any of these sections we have positively arrived at the lowest stratum containing organic remains in the crust of the earth, or have discovered the first living beings which were embedded in sediment.*' " — pp. 27–29.

And the author proceeds to read his Edinburgh Reviewer an admirable homily from some further paragraphs of Mr. Lyell's book, which, if he would himself "mark and inwardly digest," might prove equally to be written for his own

learning. If the Lower Silurian strata may, "in some as yet unexplored place not far off," contain the remains of the cephalopods which he wishes to find, why may not the remains of fish also lie lurking in the same convenient nook? The spirits of these lost races, so easily evoked to discomfit the Edinburgh critic, to "show his eyes and grieve his heart," may stand not upon the *order* of their coming in such wise as our author thinks most befitting. But passing from what *may be* to what *has been*, have not very unexpected sights presented themselves, even in these later times, to the wondering eyes of geologists, turning the elements of many a good theory into most admired disorder? The writer himself declares, that these oracles are almost every year giving forth new responses; for example, that the existence of birds at a specified era

"was not dreamt of ten years ago; the existence of tortoises in the time of the New Red Sandstone was equally unknown only two or three years earlier. It is a still less time since the labyrinthodonts of the Keuper of Germany were discovered; and we have just seen that the unqualified affirmations of the Edinburgh reviewer, as to the oldest reptiles, were overturned by intelligence from America before his sheets had seen the light." — pp. 55, 56.

It is all very well, this bringing up the "vestiges of terrestrial animals" from lower depths to mar with their footmarks a critic's pages, ere the ink was dry. But why may they not come from a lower deep still? "When these things are considered, must we not see" the generalizations of the author, no less than "the objections of the reviewer, to be extremely rash?" The fact is, that, as to deductions in this whole field of science, we have towering superstructures raised on merely negative foundations,—many a pyramid resting on its apex in unstable equilibrium, which a little delving about the spot may disturb at any moment.

On this and other accounts, we are not inclined to meddle in our author's controversy with the geologists, which occupies so large a part of his new volume. The weapons employed will not carry an edge. The *mêlée* is rather exciting, but it has come at length to have merely the interest of pantomime. We see one combatant thrust his weapon directly through the body of his antagonist, and there is an end, as we suppose. But anon he rises again, armed with some new fact, which serves at once as a magic plaster to heal

his own wounds, and a bludgeon to beat his adversary to the ground in turn. The latter proves to be only *scotched*; he soon clutches a new fact, which, like a new decision in chancery, is omnipotent over the old; and so the play goes on. We are not disposed to disparage the *science* of geology. The principal *working* geologists, the investigators, are among the ablest and soundest scientific men of our time. In no department, perhaps, has a higher order of talent been turned to better account. They are the supernumeraries, the light troops, with which every popular corps abounds, that principally carry on this guerilla warfare. Unfit and disinclined for research themselves, finding it easier to *speculate* than to *examine*, they snatch at the results obtained by others, as yet unsifted and unscrutinized, connect them with physical or physiological principles which they have imperfectly apprehended, and build splendid theories vastly attractive of popular admiration, but tending to bring the science itself into undeserved discredit when their unstable foundations are exposed to view. These are the *savans*, who, when their card-castles are jostled by a little rough handling, complain, with our author, of "the chilling repression of all saliency in investigation which characterizes the scientific men of our age."

But returning to our task, it is time to look at the direct arguments in behalf of the transmutation theory. The author maintains, that the order of creation has followed a regular progress in time, from the lowest and simplest to the highest and most complex forms of being. He affirms, not merely that the earliest fauna was composed of the lower classes of animals, and that the highest were the last to appear, — which we willingly admit, — but that the development of life has implicitly followed the scale, or series, in which plants and animals are naturally classified, proceeding from below upward, "from the simple lichen and animalcule respectively up to the highest order of dicotyledonous trees and mammalia." Thus, as to the animal kingdom, it is maintained that "we see, first, traces all but certain of infusoria"; that the several orders of radiated and the humblest forms of articulated and molluscous animals successively appeared, and were followed by higher forms of the mollusca; that fish next appeared, the humblest of the vertebrate class, but at first only fish of the most imperfect sort, partaking of the character of

the articulated animals below them. Then came land animals, of which the first were reptiles, "universally allowed to be the type next in advance from fishes, and to be connected by these by the links of an insensible gradation." Afterwards came birds, and still later the mammalian class, which also commenced with their lowest, and progressively reached their highest forms.*

Here the starting-point with infusoria is an avowed assumption, and the alleged succession of the invertebrate races is little better, while the fact is studiously kept out of view, that many of the early fossil species were endowed with a complexity of organization equalling, and even surpassing, that of any extant representatives of the same classes. The palæontologists are far from admitting these conclusions. They deny many of the particulars; they object to the general inference. To select two statements made by the highest authorities during the last year. Agassiz declares that "the zoöphytes, mollusca, and articulata existed in the earliest period of the earth's development, although all their classes were not numerously represented in the oldest members; but they do not allow of our supposing that any progressive perfection to the present creation occurred." And M. D'Orbigny concludes, that, although the earlier were in general the more simple forms of life, yet no transitions between specific forms can be detected in rocks; but living beings succeeded one another by the extinction of races and their replacement.†

Still, it may be readily allowed that the scheme of creation followed, in some sense, this general order of development, though we need not our author's hypothesis to tell us why it was so. It well comports with our general notions respecting the stages through which our earth passed ere it became habitable for man. The earliest vestiges indicate a marine theatre of existence, in which we know not whether there was any dry land at all. We have, therefore, aquatic beings alone to look for, and of such are the fossil remains. It is merely probable that the earliest were exclusively invertebrate forms; it is not probable that there was any historic progress through the invertebrate series, or even that

* *Vestiges*, 2d ed., p. 110, *et seq.*

† See *American Journal of Science*, 2d Series, Vol. II., pp. 279, 280.

there was in each order a regular sequence from the lowest to the highest forms. Vegetables must have existed for the support of these early inhabitants of the ocean. These could have been no other than sea-weeds, — so that the vegetable kingdom begins, as our theorist would have it, with one of the simplest vegetable races ; and their vestiges are found in the earliest known fossiliferous rocks. As the dry land appeared, the naked rocks were doubtless first clothed with lichens, which require no soil, or in moist places with mosses, for this if for no other reason, that the conditions were adapted to such vegetation alone. And after a soil had been formed, when, as “in the carboniferous era, dry land seems to have consisted only of clusters of islands, and the temperature was much above what now obtains at the same places,” it is quite natural that the ferns, which are still most abundant and luxuriant under similar conditions, — namely, in tropical islands, — should then have formed the prevalent vegetation, and have attained the rankest luxuriance in a sultry atmosphere reeking with moisture. Now, we do find the remains and impressions of ferns, the highest cryptogams, in vast abundance, just where our author would have them ; but the rock-legend is silent as to their precursors, the mosses and lichens. This brings our author into difficulty. If, in the absence of fossil mosses and lichens, we conclude that land vegetation began with the ferns and filicoid plants of the coal formation, the doctrine of regular progress in the vegetable kingdom is disproved at the commencement, and we must agree with the Edinburgh Reviewer, that, “as to land plants, we have not the shadow of proof that the simpler forms came into being before the more complex.” The shadow is cast directly the other way. But if our author takes the alternative, and contends that the absence of all vestiges of mosses and lichens is no proof that they did not exist at and before that epoch, how can the non-existence of other races be safely inferred from the absence of their fossil remains in any given case ?

At the next step, the writer is plunged into deeper trouble. He admits that the traces of a historic progress in the vegetable creation are less clear than he could wish, and well he may. For in “the first great burst of land vegetation,” as he phrases it, not only are the lower forms absent, so far as we can tell, but all the higher classes of plants are

actually represented. Monocotyledonous and dicotyledonous trees occur simultaneously with the tree-ferns. Or, if either class of phanerogamous plants be wanting, it is probably the monocotyledonous, the lower of the two; for recent investigations tend to show that those coal-plants which have been taken for palms are more likely cycadaceous, and that these and other dicotyledons, instead of being "extremely rare," have largely contributed to the formation of coal.* And if the highest class of vegetation was represented only by its gymnospermous division, — the Coniferae and Cycadaceae, — yet these appeared from the first in such high and perfect forms as to preclude the idea of progress.

Our author has two modes of meeting the principal difficulty. The first is a mere quibble; namely, that we are not entitled "to say that the simple and complex plants of this formation are rigidly contemporaneous; they may have followed each other within the *space of half a century*, and yet have been preserved in one stratum." These writers, who have millions of years at their command, can be very economical of time upon occasion. The second displays a logical genius of a more enterprising order. It is essential to the theory, our readers will notice, that these higher forms of plants should have a later origin than the ferns. Yet in fact, their remains are found commingled. But the writer replies, "They are *mainly* low [read *high*] cryptogamic and monocotyledonous plants"; — "the simple forms are vastly more numerous than the complex"; as if a dozen specimens did not prove the existence of dicotyledonous trees as fully as ten thousand; as if their fewness afforded even a presumption that they were recent interlopers, or reduced the objection to such insignificance that it was scarcely worth speaking of. This is just the reasoning of the unfortunate damsel upon whom the charge of maternity was too strongly fixed, and who was at length reduced to the plea, that "It was only a very little one." The objection is, not that the dicotyledonous trees were few, which may or may not have been the case, but that they were present at all. Our author, pressed by a difficulty so fatal to his theory, ingeniously argues, that, as fossil dicotyledons are more abundantly found through later periods, they may have

* *Vide* Adolphe Brongniart in *Comptes Rendus*, Dec. 1845.

made their first appearance during the last half century, as it were, of the coal-era.

“ Finding that we have first ample marine vegetation, then a land vegetation in which the plants, with only a small exception, are cellular and cryptogamic, while of the exception a very small number are dicotyledonous, and a conspicuous group (the conifers) intermediate, — I feel that I am entitled to say that positive evidence speaks for a precedence of high but simple forms.” — p. 45.

Now, in the first place, the facts on which the argument is based are invalidated by the well known experiments of Dr. Lindley, who, on subjecting the stems and branches of various trees for a long time to the action of water, showed that plants of the classes or families that are chiefly found in the coal are the very kinds whose tissues best resist decomposition under such circumstances. We allow that this evidence “ says as much for the non-preservation of mosses and other humble plants as for dicotyledons ”; and we suppose that there were mosses in those days. It all helps our argument, and shows the danger of inferring the paucity of particular races from the scarcity of their fossil remains. There is neither proof, nor strong probability, that all the leading classes of the vegetable kingdom — the low cellular, the high cryptogamic, the monocotyledons, the gymnosperms, and perhaps the common dicotyledons — were not represented in these primeval forests in much the same proportion as they now exist in low and damp tropical islands; and that dicotyledonous trees have not contributed in that proportion to the formation of coal. But, supposing even that the latter were comparatively few in number, this affords no presumption of their recent advent. When we behold a forest composed mainly of pines, but with a few beeches or oaks, can we conclude that these last are of recent introduction? Is it not quite as probable, that they are the scattered remnants or descendants of a growth that formerly occupied the soil?

We have no intention of following this portion of our author's argument into details. Nor is it necessary. It appears to be the opinion of those best qualified to judge in their respective branches of science, that he has failed to establish even this part of his case, in the mode and to the extent that his hypothesis imperatively requires.

But we will now suppose that the *savans* are mistaken, or

wilfully blind.* Let it be granted that the advent of the vegetable and animal tribes has been perfectly accordant throughout with the scale of being, — that it has strictly followed the ascending steps of the natural series, whether simple or multiple, or in whatever form our author may choose to adopt. This would neither disprove the common theory of creation, nor lend any real proof to our author's hypothesis. According to the received view, that God specifically created every living thing after its kind, it may well be that he began with the humblest and simplest kinds, — especially as the earth at first seems to have been adapted to their existence alone, — and that he followed that ascending *order* and plan which, as recognized by us in the "things that are made," has given to us the idea of a graduated scale of being. We see no good argument here against a specific creation.

Our author, however, thinks quite otherwise. He draws very different conclusions from the succession of beings he contends for, and which, for the present argument, we will suppose to have been established. His theory is, that this succession in time points to an origin of the higher and later forms through the intervention of the lower and earlier. He rejects the idea, that each species was created independently at the fit and appropriate time; but maintains instead, that the successive higher grades have, in the long lapse of ages, been evolved out of one or more primary ones; that the highest plants and animals have actually derived their parentage from the lowest sorts respectively, acquiring an "improved organization" at each step in the ascending scale; that our higher animals may be traced, though perhaps vaguely as to their particular route through the lower marine forms, yet "with tolerable distinctness as they singly pass through the four classes of fishes, reptiles, birds, and mammals," and through the last class from one stage to another, "until the second highest gave birth to MAN, who is the very highest." In plain language, his doctrine is, that all our lovely flowers and lofty trees, which now at least "yield seed after their kind," are the progeny of humble sea-weeds and lichens; and that men and monkeys, horses and dogs, fish, flesh, and fowl, are but animalcules of a larger growth and a successively more per-

* "This person, and, I am sorry to add, geologists generally, can only fasten upon such particulars as may be made out to be difficulties in the way of generalization." — p. 47.

fect development ! And this monstrous conclusion follows, our author argues, as a legitimate deduction from the alleged fact of the regular succession of the animal tribes in their appearance on the earth, taken in connection with another fact in the history of individual development, which we will presently bring to view !

Still, a serious inquirer, imagining that he has here a clew to the explanation of that unity of plan which runs through the animal kingdom, might entertain this proposition. We are quite willing to consider it, thus far, as a purely scientific question, to be settled by observation and just inference. It is one of the two conceivable views respecting the origin of the animate creation, into which all theories on the subject naturally resolve themselves. It is possible, — it only needs probability and proof. Our ingenuous inquirer, accepting it for the nonce, might say, Yes ; the Deity may have fashioned all the living races out of the same fundamental form. When higher animals were required, they may have been made, not *de novo*, from “ the dust of the ground,” from inorganic material, but the creative power may have been specifically exercised at different times, directly advancing one or more of the lower animals to higher, and again to still higher, stages of being. In this way, if need be, he might say, “ They were created by the hand of God, and adapted to the conditions of the period.” But the author peremptorily forbids our giving this construction to his theory, in the language already cited (*supra*, pp. 467, 468), by which he replies to this very statement. These “ gradations of advance,” he strenuously maintains, — that is to say, the evolution of elephants, &c., out of animalcules, — are owing to properties *generally impressed by the Deity upon matter*, at the very commencement of time. Like Geoffroy St. Hilaire, to whom, though he nowhere acknowledges it, and possibly knew it not, he is indebted for all this part of the theory, he may say, “ *I take care not to ascribe to God any intention.*” On the contrary, —

“ The immediate cause of the development of each line through its various general grades of being is to be sought in an *internal impulse*, the nature of which is unknown to us, but which resembles the equally mysterious impulse by which an individual embryo is passed through its succession of grades until ushered into mature existence. Geology shows us each line taking a long se-

ries of ages to advance from its humble invertebrate effluents to its highest mammalian forms; and this I have ventured to call the universal gestation of Nature." — pp. 50, 51.

That is to say, all the higher races of plants and animals were not, in any proper sense of the word, *created* at all, but they *grew*. The Deity did not concern himself with originating each species after its kind, according to the common acceptance of Holy Writ, but he made certain monads capable of producing any and all of them! In the whole course of the evolution, no supernatural agency is allowed to intervene. Throughout his writings, our author explicitly teaches, that the creation of species results necessarily from the operation of natural laws, — of laws as strictly natural as those through which the common changes on the face of the inorganic world are brought about, or the decomposition of a carcass effected, and no more than these requiring, either in kind or degree, the intervention of the Deity. He teaches, not only that the origination of species and the production of progeny are equally natural and truly analogous, but in fact, that the two are fundamentally the same. The one is merely a modification of the other. It is "a law to which that of like reproduction is subordinate." If we object, that this is contrary to all observation, that we behold each species producing its like and no other, our author replies, that this does not invalidate his doctrine, and that, if we would observe closely and long enough, startling facts of a different kind might come to light. The animalcules, he says, produce animalcules in abundance, but they now and then produce a polype; the polype produces polypes, and also sometimes a mollusc; one of the latter occasionally engenders a fish; the fish stealthily gives birth to a salamander or a frog; the reptile plays the same trick, and behold a bird; and the unlineal offspring of a bird appears successively as an ornithorhynchus, a kangaroo, and a common mammal. This is no caricature, but a plain statement of our author's doctrine, stripped of much verbiage, but not at all misrepresented. He must be an ingenious man who can caricature it. If our readers call for "the ocular proof" that the species have been thus untrue, they will be surprised to find that none is forthcoming, — that this downright slander is founded on some vague surmises which are worth nothing as testimony, and which ought not to bring the character even of a giddy animalcule under suspicion.

When they ask for an intelligible statement how the thing has been done, the author of the charge fathers it all upon some “*internal impulse* to us unknown,” as in our latest quotation, — or else upon “*certain external conditions*,” equally unspecified, as is intimated in the original treatise,* and affirmed in the preceding citation. But the assertion, though unproved, is nevertheless stoutly maintained. He insists that the earliest species have not only perpetuated their like in ordinary course, but also, by an analogous process, have advanced some of their offspring higher in the scale ; and these in turn, by similar impulses or accidents, have given occasional birth to animals of a still higher grade, and so on, until the last and highest result was reached in man himself. We cannot say of Dame Nature that

“ Her ‘prentice han’ she tried on man ” ;

she tried it on the animalcules. Thus each successive race, itself boasting of no better origin, has all along been producing not only its legitimate, but also a bastard or monstrous progeny, and, sooth to say, this oft-repeated and equivocal process, this long-descended, unlineal line, terminates in man ! Man, the concentration and culmination of endless ages of monstrosity, is the unlineal descendant of a monkey, which was the abnormal progeny of a fox or wolf, which may trace its pedigree rather dubiously through some of the ruminant, rodent, and marsupial tribes to the class of birds, then to the turtle, thence to fish, then to an oyster or some other mollusc, and finally to the minute polygastric animalcule ! And this is to supersede the current doctrine, that the Deity originally and specifically created each kind of animal as it now exists !

Those who would consult the genealogical table for themselves, we refer to the author’s original treatise, pages 172 and 173 ; and then, to learn how the requisite changes have been brought about, on the author’s first plan, they may read a few sentences beginning with page 159 of the second American edition. They are there told how a fish-embryo, going a step too far, — “ the straight-forward part of the gestation being protracted over a small space,” — becomes no fish at all, but a reptile ; how that, if it had taken one step more just in the nick of time, it would have turned out a

* *Vestiges*, 2d. ed., p. 161.

bird ; if still another, it might have written itself down an ass, or some other quadruped. But we must not insist upon particulars here ; for in the Explanations the plan is varied a little, though not so materially as the author would have us suppose. The following ample extract embodies the new view.

“ This [later] view suggests that development has not proceeded, as is usually assumed, upon a single line, which would require all the orders of animals to be placed one after another, but in a plurality of lines, in which the orders, and even minuter subdivisions, of each class, are ranged side by side. It also suggests that the development of these various lines has proceeded independently in various regions of the earth, so as to lead to forms not everywhere so like as to fall within our ideas of specific character, but generally, or in some more vague degree, alike. The progress of the lines becomes clearest when we advance into the vertebrate sub-kingdom. We can there trace several of them with tolerable distinctness, as they singly pass through the four classes of Fishes, Reptiles, Birds, and Mammals ; the Birds, however, being a branch in some part derived equally with the reptiles from fishes, and thus leaving some of the mammal order in immediate connection with the reptiles. The lines or *stirpes* have all of them peculiar characters which persist throughout the various grades of being passed through, one presenting carnivorous, another gentle and innocent animals, and so on. We have, therefore, in the animal kingdom, not one long range of affinities, but a number of short series, in each of which a certain general character is observable, though not always to the exclusion of the organic peculiarities of families in neighbouring lines, especially in the class of reptiles. According to this view, the matrix of organic life is, speaking generally, the sea. The arrangement appears to be this : — the basis of each line is a series of marine forms ; the remainder consists of a series designed to breathe the atmosphere and live upon land, these being all of improved organization. The classification which this system implies may be said to be transverse to all ordinary classifications. The invertebrate, ichthyic, reptilian, ornithoid, and mammalian characters are horizontal grades, through which the lines pass, and where they send off branches ; not separate and independent divisions. In any of these branches, where we have a clear knowledge of the various forms, it is possible to trace the affinities, in conjunction with an improved organization, through genera which are adapted to a partially marine life, to a residence in the mouths of rivers, or on shores and muddy shallows,

then through genera which are, in succession, appropriate to marshes, jungles, dry elevated plains, and mountains. And it is this series of external conditions and adaptations which has caused that system of analogies between various families of animals which has of late attracted attention. But the immediate cause of the development of each line through its various general grades of being is to be sought in an internal impulse," &c., &c., as already cited. — pp. 49, 50.

"Generally, the first and lowest forms of the orders in a class are marine, and often these are of comparatively large size. We usually see in them a vestige of the essential characters of the class next below. Thus, the perennibranchiate batrachia in their order, the ichthyosauri in the series of crocodilia, and the divers among birds, all exhibit an affinity to fish. The cetacea and phocidæ, which I regard as the immediate basis of the pachydermata, carnivora, and other orders of terrestrial mammals, ought, according to this view, to show an alliance to the reptiles; and such a connection does exist between the cetacea and certain marine sauria; but from the general extinction of the marine reptiles, the linking of the mammals to that lower class is less clearly seen than might be wished. . . . Exceptions as to the course which development has taken appear to be by no means few. . . . Thus, for example, the marsupials appear very clearly a development from certain birds; probably the rodent and edentate orders are derived through the same channel.

"There is a unity in all instances in the moral as well as physical characters of the various members of one stirps; we only see it advancing from low to high characters, just as we see the fœtus of a high animal passing through various inferior stages before it reach its proper mature character. The lines, moreover, being independent of each other, and not quite uniform as to the stages of animality through which they pass, it follows, that, unless we knew of some law governing their different gestative periods, we are not entitled to look for the first occurrence of their various ichthyic, reptilian, and mammalian sections in any order as regards each other, even though we could be sure (which we are not) that we are surveying a geographical region where they all started fair in the race of progressive organization." — pp. 51 – 53.

All trace back their ancestry to the ocean. The terrestrial races all crawled forth from the water, like the frogs of the second plague of Egypt; and in the famous Acarus-breeding experiments of Mr. Weekes, triumphantly detailed in the appendix to put down all unbelief, we come near to

having the third Egyptian plague realized. In the first scheme, the line ascended mainly as one, yet it was here and there thrown into folds or loops, like the ropes of onions that one sees strung upon the masts of a Connecticut schooner. It was rather cumbrous and intractable, this long line of genealogy. But by breaking it up into an indefinite number of shorter ones, the whole is more manageable, and we shall be much surprised, if the author, with but a moderate use of "extinct links," should fail to trace back the pedigree of any animal whatever entirely to his own satisfaction. The only objection is, that it multiplies the fundamental difficulty by increasing the number of *first steps* in an operation where *c'est le premier pas qui coûte*; for once show us that an animalcule has become an oyster or a fish, and we will grant it may become a horse. Still, we miss the charming simplicity of the original scheme, where any of the thousands of animalcules which sport "with ample room and verge enough" in a single drop of water was potentially a fish, an anaconda, an ostrich, a horse, and an elephant, and there was no knowing which of these grades was his *ultimatum*, — "the world was all before him where to choose." On the modified plan, all depends upon the route that is taken. If the aspiring animalcule, having attained the dignity of fish, now essay the saurian line, it may next rise to become a whale or a seal. Among the phocidæ two roads are open; if, as it steps ashore, it takes the pachydermatous route, it may turn out a hog, a rhinoceros, or an elephant; but it must early take a different course if it would be a bear, and still another if it would end its career as a cat or a lion. A different road, leading through the ichthyosauri, the salamanders, and the diving birds, leads to the opossum and kangaroo, or else to the sloth, or the beaver, as the case may be. But each line has its own *terminus* at the upper or mammalian end, which the animals that have taken that line "in the race of progressive organization," and those alone, may hope to win. We have no means of predicting what route any given infusory or marine animal will take. Whether this is "under law," or pure accident, is unexplained. "All I think that we can expect is, that, in a particular area, where we have reason to believe that the lines have started abreast, they should all reach their various grades nearly about one time."

Now the practical difficulty is, that those of the existing races which had the earliest start appear to have made no progress at all. Naturalists inform us, that the most ancient living species are some of the polygastric animalcules, and other minute and simple organisms, whose fossil remains have been detected in deposits much older than those which contain vestiges of any other existing animals. Here is a wonderful persistence of character in the very tribes that are supposed to give birth to all the rest. But the author has a proper answer to objections of this sort; namely:—“The probable fact is, that the modification takes place in an offshoot of the original tribe, which has removed into a different set of circumstances, these circumstances being the cause of the change; thus there is no need to presume that the original tribe is at all affected by any such modification.” During the interval, these very species of animalcules may have produced quadrupeds and men, for aught we know to the contrary. For the abnormal offspring is often so unlike its parent, not to say its ancestors, that our author admits, “there may be no appearance of a transition from the former species to the present,” and he is aware of no signs by which such a transition can be detected. With what grace, then, can he demand from his opponents a refutation of an hypothesis which he admits is incapable of proof? But the wonder is, that these species have not been totally changed in the long lapse of time; that any except very recent animalcules should remain in that low grade. For the present, let us note the fact as good evidence that species of the lowest grade are equally stable and true to their kind with the highest. On our author’s theory, he has still to explain how it is, that, where all the lower grades are potential mammals, just as all curates are possible bishops, and where all have apparently “started fair in the race” of preferment, so few should reach the perfect consummation, and so large a portion of the animal species, all equally capable of better things, should “wage with fortune an unequal war,” and remain in these undeveloped, rudimentary, unfledged conditions.

But we return to the author’s modified view, which might be termed *development made easy*, since it conveniently substitutes a goodly number of short ladders in the place of one long one. It amounts pretty nearly to the same thing as the original scheme, except that it leaves the pedigree of the

human race involved in much doubt and ambiguity. We presume that all the later steps of the former genealogy are still retained, — that man did not rise with Venus Anadyomene all perfect from the wave. At the seashore, the ambiguity commences. The difficulty is, not to find some route of ascent, but to choose among several, all equally probable. Whether he crawled up from original slime with the reptiles, or soared aloft at once with the flying-fish, or stepped ashore with the wading-birds, and thence

“ on ground
Walked firm, the crested cock, whose clarion sounds
The silent hours, or th’ other, whose gay train
Adorns him,”

and so from the lord of the dunghill became the lord of creation, is still a problem. Nor can we ascertain what reptile-ancestor of ours it was, who, when basking in the warm sunshine, and finding that the plumage began to cover his rough hide, might thus have chanted his *nunc dimittis* to the next higher stage of being : —

Jam jam residunt cruribus asperæ
Pelles; et album mutor in alitem
Superna; nascunturque leves
Per digitos humerosque plumæ.

But the most instructive aspect of the modified theory is its evident conformity with the old hypothesis of Lamarck. We noticed the family resemblance from the first; but the development is now complete, and those who did not identify the grub may recognize the butterfly. In thus displaying the familiar features of an old acquaintance, our theorizer saves us some trouble; for by showing its essential agreement with the leading atheistic scheme of the beginning of this century, we are relieved from the supererogatory labor of a refutation which has been again and again most thoroughly accomplished, both upon scientific and theological grounds, by abler pens than ours. By the theory of Lamarck, as in our author’s, the powers and properties with which all matter was originally endowed are *themselves* supposed to have clothed the earth with verdure, and to have peopled it with its countless races of animals, — and to have done this by a series of natural operations, productive, at first, of rudimentary plants and animals, the rough draughts of what, in the course of a long succession of ages, have ripened into the

present complexity, variety, and perfection of the races of our days. The object of the two schemes is the same, namely, to dispense with repeated interventions of a First Cause; and both reach the same conclusions in a very similar way, as will be seen from the subjoined extracts; which, instead of translating from the original French of the *Philosophie Zoologique*, we select from the abstract published several years ago by Mr. Lyell, in order that any coincidence of phraseology with the Vestiges may not be attributed to us.

In the Lamarckian view, —

“It is not the organs, or, in other words, the nature and form of the parts of the body of an animal, which have given rise to its habits, and its particular faculties; but, on the contrary, its habits, its manner of living, and those of its progenitors, have in the course of time determined the form of its body, the number and condition of its organs, in short, the faculties which it enjoys. Thus, otters, beavers, water-fowl, turtles, and frogs were not made web-footed in order that they might swim; but their wants having attracted them to the water in search of prey, they stretched out the toes of their feet to strike the water and move rapidly along its surface. By the repeated stretching of their toes, the skin which united them at the base acquired a habit of extension, until, in the course of time, the broad membranes which now connect their extremities were formed. In like manner, the antelope and the gazelle were not endowed with light agile forms in order that they might escape by flight from carnivorous animals; but, having been exposed to the danger of being devoured by lions, tigers, and other beasts of prey, they were compelled to exert themselves in running with great celerity; a habit which, in the course of many generations, gave rise to the peculiar slenderness of their legs, and the agility and elegance of their forms. The camelopard was not gifted with a long flexible neck because it was destined to live in the interior of Africa, where the soil was arid and devoid of herbage; but, being reduced by the nature of that country to support itself on the foliage of lofty trees, it contracted a habit of stretching itself up to reach the high boughs, until its neck became so elongated that it could raise its head to the height of twenty feet above the ground.” — *Lyell's Principles of Geology*, Vol. III., pp. 11, 12.

Let this be compared with the passages from the volume under review which we cited near the beginning of this article. Lamarck was well aware of the conclusions which the geologists had already begun to draw; namely, that plants

and animals of simple organization preceded the most complex. He, like our author, considered the earlier as the progenitors of the later and higher races. Adopting the prevalent idea, that the ocean invested the whole planet long after it became the habitation of living beings, he also looked to the sea as the original home of the terrestrial species, and taught that some of the shell-fish, by "gradual evolution" and "progressive improvement," were at length converted into all the variety of land animals. The "internal impulse" of our author is turned to fuller account by Lamarck; but whether the former has strengthened or weakened the theory by nominally rejecting the idea of appetences creating organs, we shall not pretend to say. Our author supposes the "external circumstances" to operate chiefly upon the embryo or offspring; this same idea, though in a slightly different form, enters essentially into the Lamarckian view, in which the impulse or appetency acts through a long series of generations, and effects a gradual advance in the offspring. When the oyster, or some such shell-fish, first aspired to crawl on land, though the will was father both to the deed and to the organs of locomotion for its accomplishment, yet it was only in the remote progeny that the effort was rewarded with full success.

"There are distinct primary rudiments of plants and animals, and *probably* of each of the great divisions of the animal and vegetable kingdoms. These are gradually developed into the higher and more perfect classes by the slow but unceasing agency of two influential principles: first, *the tendency to progressive advancement* in organization, accompanied by greater dignity in instinct, intelligence, &c.; secondly, *the force of external circumstances*, or of variations in the physical condition of the earth, or the mutual relations of plants and animals.

"Now, if the first of these principles, *the tendency to progressive development*, were left to exert itself with perfect freedom, it would give rise, says Lamarck, in the course of ages, to a graduated scale of being, where the most insensible transition might be traced from the simplest to the most compound structure, from the humblest to the most exalted degree of intelligence. But, in consequence of the perpetual interference of the *external causes* before mentioned, this regular order is greatly interfered with, and an approximation only to such a state of things is exhibited by the animate creation, the progress of some races being retarded by unfavorable, and that of others accelerated by favor-

able, combinations of circumstances." — *Principles of Geology*, Vol. III., pp. 16, 17.

Were there room for further extracts, we would show the operation of Lamarck's machinery in the transformation of the orang-outan, which, "having been already evolved out of a monad, is made slowly to attain the attributes and the dignity of man." So far as there is any difference, the scheme of Lamarck is the more plausible of the two. In both, the "circumstances" act through the parent on the offspring; but the machinery in Lamarck's theory is the more natural and intelligible. The "higher generative law" only interferes with the simplicity of the scheme. But, says the author of the *Vestiges*, "I also go beyond the French philosopher to a very important point, the original divine conception of all the forms of being, which these natural laws were only instruments in working out and realizing." This advantage cannot be conceded; for Lamarck also allowed the order of nature to have emanated from the Deity. He taught that Nature—a piece of mechanism acting by necessity—is subject to laws ordained by his will. This Nature, too, is obliged to proceed gradually in all her operations, and to begin, just as in our author's plan, by the production of the most simple kinds, and out of them instrumentally elaborate all the more complex.

But, since the animal creation has so long been running this "race of progressive organization," and arriving at such remarkable results, it becomes difficult to understand why so many species of the simplest structure are remaining, why there are still more individuals of infusoria than of all other races put together. We have already mentioned the difficulty. Lamarck meets it by the admission, that nature *is* daily engaged in the formation of rudimental plants and animals; that she *is* always beginning anew, day by day, the work of creation, giving rise to monads by what is termed spontaneous generation; and that the transmutation *is* continually going on, as busily as ever, though those forms only survive that happen to have a fortunate adaptation to the conditions in which they are placed.

This is consistent, but no doubt untrue. Our author, met by the same difficulty, offers a different explanation, totally inconsistent with his theory; namely, that *the life-originating and transmuting machinery does NOT work much or to much*

purpose NOW, BECAUSE the world is already well stocked with the higher species. This was animadverted upon, and the consequences of the admission shown, in our former article.* The author, however, is so well-satisfied with his singular argument, that he has repeated it in the "Explanations." The peopling of the earth, he says, "is a thing done," and "we are not, therefore, to expect conspicuous examples either of a new origin of life, or a modification of species, at the present day." Doubtless it is a thing done for those that have reached the top of the scale, though not for the rest. But who knows that it is "*a thing done*," and that "a vacant globe is amply supplied with suitable tenants," in the shape of men, horses, and oxen? Is it the lower animals who are running "the race of progressive organization?" Do they, then, become discouraged and stationary, or remain only "faintly at work," for fear of bringing their humanity or bestiality to an overstocked market? And are they likewise the judges of the "very special and extraordinary circumstances" that now and then make it worth while to move on? Then they are not only wiser than their Creator, according to the terms of the theory, but have vastly more forethought than their fortunate brethren who have already attained the human form divine! The only alternative must be, that it is the Deity who knows that the world is properly stocked. It must be the Deity, then, who, at the fitting period, checks or arrests the operation of "the life-originating machinery." And is not an interposition to suspend a law supernatural? If Deity may thus in the course of time interpose to arrest, why not as well specifically to create? And if the necessity of a single interference be shown, the whole hypothesis falls to pieces. To what purpose have the converts to this scheme been forced to receive this series of gratuitous and most improbable suppositions, all this false science pressed to the most revolting conclusions, for the express object of banishing the Deity from the present world, if, when all is done, even this machinery is insufficient to exclude him?

Our readers have probably seen enough of the transmutation theory, as a substitute for specific creation. Still we must examine, though with the greatest brevity, the remain-

* See *North American Review* for April, 1845, p. 463.

ing considerations adduced in its support. By referring the origin of each species to the direct creative agency of the Deity, we refer it to an adequate cause, — to the only cause, so far as we yet know, which will account for the facts. Now, those who adopt the other view, and carry the principle *nec Deus intersit* to this length, are bound to show that natural agencies are competent to produce such results as these. The burden of proof rests upon them. Either let them show how the thing may be done, or let them bring instances of direct transmutation before us. Our author attempts both. As to the latter, we have the old story from Virgil : —

“ *Grandia sæpe quibus mandavimus hordea sulcis,
Infelix lolium, et steriles dominantur avenæ* ”;

or, in the version of worthy Master Gerarde, —

“ In furrowes where good Barley we did sowe,
Nothing but Darnell and poore Oates doo growe.”

This, or rather its converse, has been verified of late years, it seems. “ A gentleman who travelled in Germany was assured, that if oats are sown early and not allowed to produce ears for the first year, they will change to other sorts of corn.” Still, as some people will not be convinced by hearsay, nor believe all the stories brought from Germany, it might be well to try the experiment. An instance is triumphantly appealed to. “ The Reverend Lord Arthur Hervey, in the year 1843, sowed a handful of oats, treated them in the manner recommended, by continually stopping the flowering stems, and the produce, in 1844, has been for the most part ears of a very slender barley, having much the appearance of rye, with a little wheat, and some oats.” In citing this account from the *Gardener's Chronicle*, our author has left out certain points which we will supply. We have turned again to the article from which our author has ingeniously chosen his extracts,* in order to confound all skeptics with Dr. Lindley's high authority ; and we find that this botanist, notwithstanding some flourishing demonstrations on that side of the question, will not assume a jot of responsibility ; but as to the transmutation, remarks, “ We are not so *very* sure about the matter, although *we do still hold hard to the orthodox faith in the matter of species* ” ; — that is, to their permanence.

* *Explanations*, p. 78. The article quoted is in the *Gardener's Chronicle*, August, 1844, p. 555.

He closes by suggesting new experiments, and very properly suspends all judgment until Michaelmas, 1846 ! Dr. Lindley also records — what our author has neglected to copy — the careless manner in which an experiment that was to fix or unfix our belief in the permanence of species was conducted. “ A handful of oats was taken out of a manger, sown in a garden, diligently cared for, and finally reaped.” The harvest contained “ some oats ” ; might not a handful of grain snatched from the Marquis of Bristol’s manger contain also some wheat and barley ? The growing grain, treated after such a fashion, would be likely to yield “ a very slender barley.” And if only oats had been sown, what was to hinder some wicked marplot from scattering a little wheat and barley among it, to diversify the result, and mystify the noble, but not very careful, experimenter ?

Our author lays most stress on the other line of argument. He has a scheme, we have seen, for explaining, on purely natural principles, the origination of new species, kinds, and classes of the whole vegetable and animal kingdoms in all their variety. But has he any vestiges of proof to adduce in its behalf, besides the *historic succession*, which we have already sufficiently considered ? We have shown, that, if this whole class of alleged facts were made out, — which is not the case, — his hypothesis would still be as baseless and gratuitous as before. The whole remaining argument is drawn from the history of *individual development*. It appears, — to make the statement general and comprehensive, — that the earliest embryo state of the higher animals is strikingly analogous to the perfect state of the very lowest animals ; there is a resemblance in form, and in other external characters, which we will not stop to specify. It further appears, that, in their ulterior development, some of the organs of the higher animals pass through stages generally analogous to, or in some sort resembling, the perfect state of the same organs in the tribes next beneath them in the scale. Thus, the brain of a quadruped at first *simulates* the brain of a fish, then that of a reptile, next that of a bird, from which it soon passes to its own proper type and specific form. The same scheme is traceable in the vegetable kingdom. The proper inferences from all this are familiar to the students of modern physiology. The gratuitous and false inference is to be found in our author’s volume ; its refutation, in our former article. Our

readers will not require us to go over the ground again until new evidence or argument is adduced. And it is the less necessary now that the author has varied his ground so as to stultify his own conclusions.

We charged him and his school with forgetting that analogy is very different from identity ; with overlooking the turning-point of the whole question, and drawing inferences which are not only gratuitous, but contrary to the whole bearing of the evidence. All observation goes to show, that the specific character is fixed from the very commencement, and that there is no more likelihood of an embryo, than of an old, monkey developing into a man. The character of the predestined oak, for instance, is doubtless as definitely fixed in the earliest rudimental condition as it is in the acorn and the seedling. Its specific individuality — that which is to render it an oak, and not a pine, a white oak, and not a live oak — is fixed long anterior to the development of the specific form ; so that the most perfect outward resemblance *then* to some other species does not argue its identity with it, while, on the other hand, its final uniform evolution after its parental kind *proves* directly the contrary. But our author most gratuitously maintains that the early similarity is essential identity, — that a quadruped or man *is* an animalcule, which, by a series of developments, has at length reached the highest grade of corporeal being.

The author now declares, however, that his reviewers, ourselves among the number, have misrepresented him ; that he only means, the germs of all creatures are *alike*, not that they are *identical*. “ The phrase used in the book was, ‘ that the embryos of all animals are not distinguishably different from each other,’ which is a very different proposition.” So it is. But we were formerly under the impression (which the perusal of the new volume has entirely removed) that the author wished to preserve some logical connection between his premises and his conclusions. His theory absolutely demands the meaning which his language plainly asserted. Thus,

“ The frog, for some time after its birth, *is* a fish with external gills, and other organs fitting it for an aquatic life, all of which are changed as it advances to maturity and becomes a land animal. The mammifer only passes through still more stages, according to its higher place in the scale. Nor is man himself exempt from this law. His first form is that which is permanent

in the animalcule. His organization gradually passes through conditions generally resembling a fish, a reptile, a bird, and the lower mammalia, before it attains its specific maturity. At one of the last stages he exhibits an intermaxillary bone, which is characteristic of the perfect ape ; this is suppressed, and he may then be said to take leave of the simial type and become *a true human creature.*" — *Vestiges*, 1st ed., p. 151.

We cannot say much for the writer's candor in his new volume ; but he has been baited by critics, and driven to extremities, and we are charitable. The reasoning was, and could have been, nothing but this :—Man's "first form is that which is permanent in the animalcule" ; *therefore*, man is a developed or advanced animalcule ;—which is logical enough, if we put the natural construction upon the whole language. The corrected view is :—The animalcule and the first form of the human embryo *look* alike ; *therefore*, man is a developed animalcule ! At first, the embryos of an oak and a pine "are not distinguishably different from each other" ; *therefore*, one is the ancestor of the other, or both had a common ancestor in some lichen ! We cannot overturn this part of our author's theory more effectually than he has done it himself. Such is the reasoning which is to give a new aspect to science, and to effect "a complete revolution in the view which is generally taken of our relation to the Father of our being" !

The inquiry naturally arises, What is the meaning of the facts alluded to, derived from the progress of individual development, and the many others that natural history abounds in,—some of which, such as the existence of rudimentary organs, have been so abused by Lamarck and our author ? Doubtless, this : that living beings have been created upon a foreordained, harmonious plan ; that the animals of each great division or class have been formed according to a common type, which may be traced as a basis through the whole ; and that the affinities or resemblances we behold, and which so mislead our author and his school, spring naturally and necessarily from this fundamental unity of plan ; that the various kinds or genera of each class or order are modifications (not of any animal of this or a lower class, but) of the type or ideal plan which it has pleased the Almighty Creator to follow, — modifications, by express and specific design, adapting each species to the conditions in which it is intended to live. Thus would we account for that unity in the midst of

diversity which the naturalist observes and admires, when with enlarged vision he sees that all the apparent complexity around him is pervaded by, and based upon, a real simplicity and harmony. It is this view, and not our author's scheme, as he absurdly suggests, that is "faintly foreshadowed" by Plato's doctrine of archetypes or preëxistent models. It is this view which well grounded naturalists have ever delighted to contemplate, as affording the highest evidence of design, — of design at once the most comprehensive and the most special. Did our limits allow a development of the topic, we trust we could show, what some eminent and excellent writers seem to doubt, that the sound doctrine of *unity of plan* is perfectly consistent with that of *special intention* to a discoverable end or purpose. Here, we merely allude to the incomparable advantage of this doctrine as coinciding with the *works* themselves in bringing the Creator directly to view; that he may be "clearly seen" and his attributes illustrated "by the things that are made." And every work of science, rightly begun and continued in this view, is, to adopt the noble language of Galen, "a religious hymn in honor of the Creator"; while our author's futile scheme is but a heathenish incantation with which he would fain exorcise the Deity out of the world he has made.

Nor is this too strong a charge to bring against a system which attempts to thrust the Creator out of the visible universe far back to the remotest verge of time, and to confine him there bound fast by the very laws he ordained. For where will our author allow any direct action of the Deity? Not, we have seen, when "man became a living soul"; not when "every beast of the field, and fowl of the air, and every thing that creepeth upon the earth," appeared; not when the waters were stocked with fish; not even when the first rudimentary animals, the all-prolific animalcules, came into being. We have not yet traced the stream of second causes to its head. These animalcules, the writer teaches, sprang from mere earth, without the intervention of direct creative power: under purely natural and existing agencies, particles of lifeless matter, acted on by chemical attraction, heat, light, and, that last refuge of a hard-pressed theorizer, electricity, came into being and have risen to every form of organized existence.*

* Upon the subject of spontaneous generation there is nothing essential to be added to our former article, until the proper test-experiment is made.

It would be something to rest here, — to set foot upon the firm ground of direct creative agency, when the round and solid world was first stocked with incipient living things. But the iron chain of *law* is around us, and we are dragged farther backward still, even to the great abyss of "fire-mist," filling all space, before we get a glimpse of any direct operation of the Deity in creation. We are asked to contemplate the universe in the nebular state, resolved into inconceivably thin air, and to imagine that the whole work of creation was potentially done *THEN*, expressed in the properties then impressed upon matter, — of which every subsequent change, every operation that has since taken place, every form and grade of animate existence, life, sensation, thought, and feeling, and *man* himself, body and soul, are only the *natural DEVELOPMENT*.

There is left to our author only one more step to take in the path he has all along so unfalteringly trodden. To that short and consistent step he is impelled by the accumulated force of his whole argument. He has admirably pushed back the Creator to a point where there is no longer any use for him. Why not suppose that the properties were *always* inherent in the matter to which they have inhered so long, and by which they have done every thing? We have long since got far beyond the Christian's God. Let Him not be introduced at all in connection with such a scheme of creation and no-providence. Our author may have a first cause to satisfy the logical necessities of the case, and he then rests secure in his position, which we have heard well characterized as "the only system of atheism that is possible to a sane mind." In fundamental character, how does it differ from the doctrine of Epicurus? We do not forget our author's declaration, that by *law* he does not mean "a system independent or exclusive of Deity, but one which only proposes a certain mode of his working." It is the very extraordinary "mode of working," if *working* it may be called, that we protest against. When read in the light of our earlier extracts, and contemplated in connection with

Professor Schulze's experiment, which our readers will remember, furnishes a fair case, where, the proper precautions being taken, no infusorial or other life appeared in a solution abounding with organic matter. Let Mr. Weekes manipulate with his solutions under the same precautions, and if he then breeds an *Acarus*, it will be time to look at his experiments.

the whole scheme, this is strikingly similar to the adoration of the white elephant by an Oriental people, who carefully imprison their god, give him nothing to do, and then render him divine homage.

We are concerned only with the logical results of the scheme ; and these are quite unaffected by the moral reflections interspersed, which so gild and bedizen the flimsy reasoning, that the whole passes for pure and solid gold with his æsthetic admirers around us. But there is no organic connection between them. These rags of religious sentiment, in which our author swaddles the offspring of his fancy, doubtless render its appearance more becoming in his eyes. Others, with stricter consistency and a different taste, may infer that the child, "when least adorned, adorned the most," would look better as well as more natural in naked simplicity. Contemplating all nature from the ultimate point of view, two propositions alone are possible : there is a God ; there is no God. From the first, the scheme which our author rejects may be consistently deduced ; from the second, the scheme he adopts flows with logical directness.

We meant to devote a few paragraphs to exposing the radical infirmity of our author's mind, — the childish facility with which he is ever deceived by casual analogies. An important and needful dissertation might be written on the use and abuse of analogy, that unsafe guide to those who are not familiar with their way already, though a very instructive and tricky companion for those who are. Its use affords a good test of high scientific ability. Just analogies, rightly seized, give both happy illustrations and fruitful suggestions. Used indiscriminately or unskilfully, they but "shine to bewilder, and dazzle to blind." To a lively and uncurbed fancy, occupied with subjects like these, all nature is apt to appear like a vision in a kaleidoscope ; where the objects in the field of view, turn them as you will, are always perfectly symmetrical, and are repeated on all sides with every reflection. The discriminating, investigating observer discerns the real state of the case ; but ardent theorizers, if they care to build on fact rather than fancy, would do better with plain glasses. Resemblances, whether casual or intimate, crowd upon our view from every side. The investigator, unless armed with Ithuriel's disenchanting spear, oftener needs to eliminate and exclude than to invite them. But let an in-

genious person select from the unlimited store, and arrange his analogies to suit himself, and he can prove just what he likes, so far as analogy affords any proof.

We have had experience of our author's success in this respect. Let us notice still another, a crowning instance. Nothing will convince him that the *Arbor Dianæ* and other dendritic crystallizations do not illustrate the laws of vegetation, and render more probable the spontaneous production of plants from mineral matter. He seems to have been puzzled, however, with the fact, that these crystallizations simulate trees, instead of plants of the lowest order. But to his great delight, a mineral fungus has at length been produced. "In a letter of Mr. Crosse to Mr. Leithead, it is stated, that in one of his experiments there grew, in the inside of an electrified jar filled with hydrosulphuret of potash, a mineral fungus, *in the shape of a common trumpet-mouthed fungus which is found on trees.*" Mr. Weekes also by crystallization produced "a singularly beautiful electro-vegetation, *a forest in miniature*, which, by aid of a good lens, presented many extraordinary appearances." He allows that the fungus-looking thing is not a plant, and that the arborescence is neither a tree nor a forest, any more than the cloud upon which Polonius theorized was a camel, a weasel, or a whale. Yet they are "very like," and he insists that the cause of the resemblance must at bottom be the same. Like effects, he reasons, must betoken the same or a similar cause. Let us see. The trees which the sketcher copies with his lead-pencil, or the painter imitates in natural colors, bear a much closer resemblance to veritable trees. Have these phenomena a "common root"? Are like causes here concerned in producing the similarity of effect? The modeller with his trowel constructs from the plastic clay the perfect form of a man. Does this point to "some relation of a very interesting kind, the investigation of which may yet give us a deeper insight than we now enjoy into the mysteries" of the creation of man?

Since our author complains so much of the reception, or rather non-reception, of his *new* theories, by an ungrateful scientific world, we cannot forbear mentioning, at the risk of apparent ungraciousness, that no one branch of his hypothesis *is* new in science. To the *savans*, they have not the charm of novelty. The nebular theory belongs to Her-

schel and Laplace. The writer's originality consists in his incorrect statement of it in a material point, and his failure to appreciate the real difficulties in the way of its application to world-making. Spontaneous generation and transmutation are too old and familiar to father upon any one in particular. Our author has the credit of omitting some of the strongest arguments that are urged in their behalf, and of pressing some of the most absurd ones. The development scheme is just that of Lamarck, with the modifications of St. Hilaire, sustained now and then by special arguments, which, we allow, these veteran naturalists never dreamed of. All these speculations, if we may judge from the general testimony of scientific men, have been repeatedly weighed in the balance of searching inquiry, and found wanting.

Still the author has claims to originality, which we shall not controvert. Among them is the declaration, that *there MAY be a faith derived from his view of nature*; that, "immeasurable as is our distance from God, we are still immediately regarded and cared for by him." Our author will really accomplish something new and strange, when he inverts the whole tendency of his theory, and shows that this important truth is either deducible from, or compatible with, it. Thus far, the only ground of encouragement is, that, although the individual may suffer remedilessly, the race is going on to perfection; that, when "man is transferred to the list of extinct forms," some perfected form of being may succeed him, just as we have succeeded the extinct saurian and other races.*

Though, indeed, "the faith may not be shaken, that that which has been endowed with the power of godlike thought, and allowed to come into communion with its Eternal Author, cannot be truly lost," it is only because the views which our author has so laboriously (and, we doubt not, honestly) endeavoured to sustain cannot be proved, and will not be logi-

* Somewhat novel, also, is the ground on which he "establishes the universal brotherhood and social communion of man," and strengthens the common dictates of humanity in respect to the treatment of the inferior animals. We are to love each other, not because we are brethren in the usual sense, but because of our common descent from the lower animals; and we are never to tread upon a worm, not exactly on the principle of the Bramin, who fears he might unwittingly remand the beast-imprisoned soul of an unfortunate ancestor to a worse penance, but rather out of respect to our own remoter ancestors by the collateral *undeveloped* line!

cally carried out. So far as this scheme reflects light on the hopes of man, all, — to adopt the writer's expressive language, — all is indeed "gone, lost, hushed in the stillness of a mightier death than has hitherto been thought of!"

In conclusion, our author frankly admits, though he deems it hardly necessary to advert to such a fact, "that *nearly all the scientific men are opposed to the theory of the Vestiges.*" To the general reader, it must appear strange that his assent is demanded for a scientific theory that is generally rejected by scientific men. The author has a way of his own for neutralizing the natural effect of the admission. He doubts whether the *savans* understand science. Since he cannot render them tributary to his purpose, his only alternative is to annihilate them, or to reduce them to insignificance. He spares them to be merely "hewers of wood, and drawers of water," and diggers after "minute facts," — useful people, no doubt, in a small way, but whose opinions are of little worth, even in the matters of their own vocation.

"As the case really stands, the ability of this class to give, at the present time, a true response upon such a subject, appears extremely challengeable. It is no discredit to them, that they are, almost without exception, engaged, each in his own little department of science, and able to give little or no attention to other parts of that vast field. From year to year, and from age to age, we see them at work, adding, no doubt, much to the known, and advancing many important interests, but, at the same time, doing little for the establishment of comprehensive views of nature. Experiments in however narrow a walk, facts of whatever minuteness, make reputations in scientific societies; all beyond is regarded with suspicion and distrust. The consequence is, that philosophy, as it exists amongst us, does nothing to raise its votaries above the common ideas of their time. There can, therefore, be nothing more conclusive against our hypothesis in the disfavor of the scientific class, than in that of any other section of uneducated men. There is even less; for the position of scientific men with regard to the rest of the public is such, that they are rather eager to repudiate than to embrace general views, seeing how unpopular these usually are. The reader may here be reminded, that there is such a thing in human nature as coming to venerate the prejudices which we are compelled to treat tenderly, because it is felt to be better to be consistent at the sacrifice of even judgment and conscience than to have a war always going on between *the cherished and the avowed.*" — pp. 124, 125.

Remembering that the cobbler was allowed to dictate to Apelles in the matter of a shoe-tie, we should imagine that the men who have devoted their lives to scientific researches would be best fitted to pronounce, "each in his own little department of science," both as to the facts themselves and as to their immediate meaning or bearing. When, therefore, the unprofessional reader of the *Vestiges* learns that Brewster condemns its physics, Murchison and Lyell and Sedgwick its geology, that Cuvier (in advance), as well as Professor Owen, Agassiz, and others, scouts its comparative anatomy and physiology, Whewell its whole logic and philosophy, and every sound-minded man we have yet heard of, its theology and tendency, — why, we ask, should not the unprofessional reader rely upon their independent testimony, in respect to facts which they are the most competent witnesses of, and inferences of which they have the best means of judging? We may go farther, and say, that, in spite of the natural bias of a special pursuit, any such man, deeply versed in a single department, is much better qualified to judge of the whole scheme, than one who, like our author, professes to possess only a superficial acquaintance with any branch of science whatever. Who but the men of research have ever established sound and comprehensive views of nature or have made stable generalizations in any branch of science? Did Newton, Herschel, Laplace, Cuvier, Davy, De Candolle, or Humboldt, give to the world mere naked facts, the germs of great views that had to fall into other minds ere they were developed or grew fecund? Although the charge of "intellectual timidity" will somewhat amuse as well as surprise the philosophers, from its direct opposition to the allegations generally brought against them, it is quite too bad to denounce them at the same time as hypocrites, who habitually avow one set of opinions in deference to popular prejudices, while they cherish another, so that they become at length the dupes of their own double-dealing! It is not on this ground, let the author be assured, that the theory of progressive development finds so little favor with naturalists; but because it is really as repugnant to their reason, and contrary to their observation, as it is to the common sense of mankind, they join the world in general in rejecting it.





3 2044 019 891 332

**THE BORROWER WILL BE CHARGED
AN OVERDUE FEE IF THIS BOOK IS
NOT RETURNED TO THE LIBRARY ON
OR BEFORE THE LAST DATE STAMPED
BELOW. NON-RECEIPT OF OVERDUE
NOTICES DOES NOT EXEMPT THE
BORROWER FROM OVERDUE FEES.**

**Harvard College Widener Library
Cambridge, MA 02138 (617) 495-2413**

